Project Manual

for

Middle School 8

PBK Project No.: 240541

for the

LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

13 October 2025

Issue for Proposal

11 Greenway Plaza, 22nd Floor \\ Houston, Texas 77046 \\ P 713-965-0608 \\ F 713-961-4571 \\ PBK.com

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Board of Trustees

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Ms. Jacci Hotzel	Vice President
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Team

Architect
PBK
11 Greenway Plaza, 22nd Floor
Houston, Texas 77046
Phone: (713) 965-0608

Structural
Kubala Engineers
11 Greenway Plaza, Ste. 1510
Houston, Texas 77046
Phone: (713) 940-3343

MEPT
LEAF Engineers
11 Greenway Plaza, 15th Floor
Houston, Texas 77046
Phone: (713) 965-0608

Civil
Kaluza, Inc.
3014 Avenue I
Rosenberg, Texas 77471
Phone: (281) 341-0808

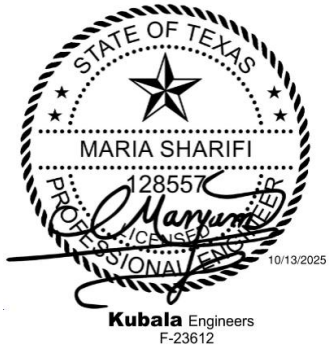
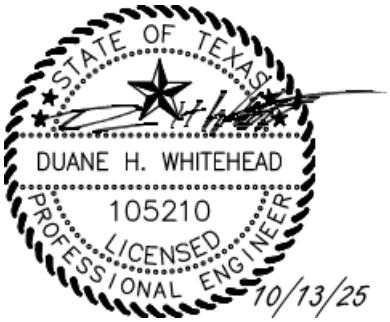
Facilities
BEAM Professionals
11 Greenway Plaza, 15th Floor
Houston, Texas 77046
Phone: (713) 965-0608

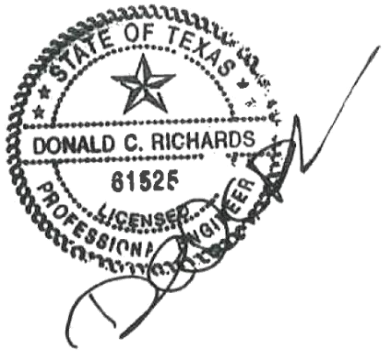
Food Service
FDP
25317 Interstate 45
The Woodlands, Texas 77380
Phone: (281) 350-2323

Landscape
Edgeland Group
11 Greenway Plaza, 15th Floor
Houston, Texas 77046
Phone: (713) 460-0988

Issue for Proposal

Each specification section included herein is listed in the Project Manual Table of Contents with a letter code, indicated below, designating the Designer of Record responsible for its preparation, under whose seal and/or authority it is issued for the purpose(s) stated above. Seals and signatures do not apply to documents not included herein, nor (except as otherwise indicated) to documents prepared by the Owner or others ("O"), including but not necessarily limited to documents in Division 00, geotechnical and other reports, etc.

Architect of Record: Michael Houy R. A.# 28012	 10/13/25	PBK Architects 11 Greenway Plaza, 22nd Floor Houston, Texas 77046
Architect of Record, Landscape: Jacob T. Galles R.L.A# 3022		Edgeland 11 Greenway Plaza, 15th Floor Houston, Texas 77046
Engineer of Record, Structural: Maria Sharifi P.E# 128557		Kubala Engineers 11 Greenway Plaza, Ste. 1510 Houston, Texas 77046
Engineer of Record, Civil: Duane H Whitehead, P.E. P.E# 105210		Kaluza, Inc. 3014 Avenue I Rosenberg, Texas 77471 TX Firm-1339

Engineer of Record, Mechanical: Mital Patel, P.E. P.E# 111622	 October 13, 2025	LEAF Engineers 11 Greenway Plaza, 15th Floor Houston, Texas 77046
Engineer of Record, Electrical, & Plumbing, Technology: Donald Richards, P.E. P.E# 61525	 October 13, 2025	LEAF Engineers 11 Greenway Plaza, 15th Floor Houston, Texas 77046

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SECTION 00 11 00 - REQUEST FOR COMPETITIVE SEALED PROPOSALS

Competitive Sealed Proposals for the work identified below in accordance with Proposal Documents and addenda as may be issued prior to date of proposal opening will be received by the Board of Trustees, Lamar Consolidated Independent School District, until proposal closing date and time, as identified below. Proposals from Offerors will then be opened in public and read aloud.

OWNER:	Lamar Consolidated Independent School District 3911 Avenue I Rosenberg, Texas 77471 Representative: David Krumrey
PROJECT:	Middle School 8 32820 Tiger Run, Brookshire, Texas 77433
EST. BUDGET:	$47,000,000.00
PREPROPOSAL CONFERENCE	Tuesday, October 21, 2025, @ 10:00AM LCISD Bond Planning Office Conference Room 104 5015 Commodore Drive, Rosenberg, Texas 77471
PROPOSAL DATE AND TIME:	Base Proposal Due: Thursday, November 20, 2025, @ 2:00PM Alternate Proposals Due: Thursday, November 20, 2025, @ 3:00PM
LOCATION OF PROPOSAL OPENING:	LCISD Purchasing Department 4901 Avenue I Rosenberg, Texas 77471
ARCHITECT:	PBK Architects, Inc. 1601 Main Street, Suite 104 Richmond, Texas 77469 Phone: 346-295-8150

In addition, proposal documents can be reviewed at the following locations:

Virtual Builders Exchange
7035 W. Tidwell, Bldg J, Suite 112
Houston, Texas 77098
F: (832) 613-0344
www.virtualbx.com

ConstructConnect
(Formerly iSqFt & CMD)
Phone: (800) 364-2059
www.constructionconnect.com

Dodge Data & Analytics
4300 Beltway Pl, Suite 150, Arlington, TX 76018
(877) 784-9556
www.construction.com
https://dfmgr.construction.com/dfmgr/login

Submit Proposals to the Owner no later than the date and time specified. Submit proposals in duplicate in a sealed envelope in accordance with Document 00 20 00 Instructions to Offerors with the following information on the face of the envelope.

Name of Offeror (General Contractor)
Middle School 8
Lamar Consolidated Independent School District
Attn: Brandi Pittman, LCISD Director of Purchasing and Materials Management

The Owner reserves the right to reject any and all proposals and to waive any irregularities in the Competitive Sealed Proposal process.

No proposal shall be withdrawn within 30 days after the proposal opening without the specific consent of the Owner.

PROPOSAL BOND: A Proposal Bond from a bonding company acceptable to the Owner or a certified check in an amount equal to 10% of the greatest amount proposal shall accompany each Offeror's proposal.

PAYMENT BOND AND PERFORMANCE BOND: A Payment Bond and Performance Bond, each in an amount equal to 100% of the Contract Sum conditioned upon the faithful performance of the Contract will be required. Please note that all bonding companies presented must be acceptable to the Owner.

The prevailing rates of wages are the minimums that must be paid in compliance with applicable laws of the State of Texas.

Offerors submitting a proposal are encouraged to visit the site. All Offerors submitting a proposal are encouraged to attend the proposal opening.

Subcontractors and Suppliers intending to submit proposals to General Construction Offerors are required to prepare proposals based on a complete set of proposal documents. If after reviewing the complete set of proposal documents, Subcontractors and Supplier Offerors desiring to purchase individual drawings and specification sections for their proposal convenience, may do so by ordering the specific drawings and specifications directly from the reproduction company.

Subcontractors and Suppliers purchasing a partial set of proposal documents are responsible for determining the documents it requires and is responsible for costs associated with printing and delivery. Subcontractors and Suppliers exercising this option shall agree that 1) all documents shall be returned to the Architect, without refund, after submitting a proposal, 2) the documents shall not be used on other construction projects, and 3) that the subcontractor or supplier agrees that the Owner and the Architect have no responsibility for errors or interpretations resulting from the use of incomplete set of proposal documents.

Successful Subcontractors and Supplier Offerors may retain their Proposal Documents until completion of the construction.

END OF DOCUMENT 00 11 00

EVALUATION CRITERIA FOR PROPOSAL

This proposal shall be evaluated using the evaluation criteria listed below.

	Evaluation Criteria	Point System
1	**Purchase price –** Proposal should offer a fair and reasonable price for services to be procured by Lamar CISD. Pricing will be calculated using the Price Delivery Sheet in this document.	40
2	**Reputation of the vendor and of the vendor's goods or services –** Proposer should have a solid reputation with other ISDs, government or collegiate entities that shows a high level of customer service and a high level of quality of goods or services. References will be contacted via e-mail.	10
3	**Quality of the vendor's goods or services –** Overall assessment of vendor's services. Vendor will be expected to meet schedules and operate with minimal disruption in accordance with the outlined specifications.	10
4	**Extent to which the goods or services meet the district's needs** Assessment of Submitted Project Plan and Schedules	10
5	**Vendor's past relationship with the district** 8-10: Good business with LCISD, staff recommends use again 5-7: Good business with no documented issues **OR** never performed business with LCISD but has experience with other school districts or government entities. 1-4: Past performance was documented as being poor**.**	10
6	**Proposed team offers experience and knowledge base required for the project** • Organizational chart of proposed project team • Resume of each proposed team member	10
7	**Ability to provide proper bonds and insurance requirements –** Provide proof of proper insurance and bonding capacity.	5
8	**Safety Record** Vendor must submit copy of Experience Modifier Rate (EMR) for the last three years. The totals for the three years are calculated and averaged to receive the points below. 5 - EMR of .50 or less 4 - EMR 0.51-0.85 3 - EMR 0.86-0.99 2 - EMR greater than 1.0 1 - EMR not included	5
9	**Total**	**100**

CRITERIA NOTES:

Careful consideration should be given to all items of the above Evaluation Criteria table. The points awarded to each item will be based on **how well each submission:**

1. Provides thoroughly developed, competitive pricing using the tables in Pricing Delivery Information of this CSP.

2. Provides evidence of experience in general and the ability to perform services to a district similar to Lamar CISD and names & contact information for references.

3. Provides evidence related to the quality of services, as well as the results of references provided by each respondent.

4. Provides an effective plan and schedule that addresses the scope presented in the request for proposals.

5. Provide list of history of projects with Lamar CISD.

6. Provides information describing experience and qualifications of onsite leadership and key staff to be assigned to the contracted work.

7. Provides an adequate and current certificate of insurance coverage.

8. Provides evidence of participation in an OSHA compliant safety program and any other safety policies in place.

PLEASE PROVIDE RESPONSE TO EACH OF THESE CRITERIA QUESTIONS IN YOUR SUBMISSION PACKAGE.

DOCUMENT 00 20 00 - INSTRUCTIONS TO OFFERORS

1.1 QUALIFIED OFFERORS

A. Proposals will be accepted from qualified General Contractors only for the entire scope of work described in the Contract Documents. As a prerequisite to a Contractor's qualifying for the award of contract on this work, the Contractor must complete each item of the Contractor Information and Experience Statement (AIA Document 305™) to be submitted digitally, physical copies to be submitted along side proposal on bid date. The Statement forms may be obtained from the office of the Houston Chapter of the American Institute of Architects (A.I.A.), 315 Capitol, Suite 120; Houston, TX 77002. The Statement and 6 references of similar projects with current/verified phone numbers, email address and current/verified fax numbers for references of Owner and Architect (refer to Exhibit A on page 9), shall be submitted to the Architect by 5:00PM CST on Friday, April 11, 2025. Digital submissions shall be submitted to Gianella Cevallos, Gianella.cevallos@pbk.com on Friday, April 11, 2025.

B. The primary purposes of the evaluation process will be to:
   1. Gather information for the Owner's evaluation procedure.
   2. Enable the Owner and/or Architect to evaluate the Offeror's qualifications.

C. After review of Proposals and Contractor's qualifications evaluation the Owner will make his decision and each Offeror will be notified.

D. In arriving at his opinion concerning the Offeror's qualifications, the Architect will use the same criteria that the Owner will use in determination of the successful Offeror as detailed hereinafter.

E. In the event a proposed Offeror fails to submit the specified Contractor's Qualification Statement at time of receipt for Proposals, such noncompliance shall be considered by both the Owner and Architect as a negative factor in the determination of the successful Offeror.

1.2 OFFEROR'S PRESENTATION

A. Each Offeror by making his Proposal represents that:
   1. He has read and understands the Proposal Documents and his Proposal is made in accordance therewith.
   2. He has thoroughly familiarized themselves with Division 01 General Requirements as they are applicable to subsequent specification sections.
   3. He has visited the site, has familiarized himself with the local conditions under which the work is to be performed and has correlated his observations with the requirements of the proposed Contract Documents.
   4. He agrees to comply with the requirements of the following paragraph. Any Offeror who subsequently does not agree to comply with these requirements will automatically disqualify himself from proposing or receiving award of the contract.

B. He agrees that:
   1. Work on the project will begin immediately upon receipt of signed Contract or Notice to Proceed.
   2. Offeror will participate as a team member in cooperation with the Project Architect, Engineers, Owner, and Owners agents and/or consultants.
   3. The Offeror will assign a competent full-time superintendent, to the project, and that superintendent shall be maintained on the project for the duration of the project, subject only to his continuous employment.
   4. The Offeror will furnish and pay for a proposal bond in the amount of ten percent (10%) of the contract amount.
   5. If awarded, the Offeror shall furnish and pay for a Performance Bond and a Payment Bond each in the full contract amount.

6. Offeror shall carry and keep in full force for the duration of the Project, insurance coverage for builder's risk, workmen's compensation, comprehensive general liability, and automobile liability as required by the General Conditions and/or Supplementary General Conditions of the Specifications.
7. Proposals shall include costs for a Broad Form Builder's Risk/All Risk, “all-risk” or equivalent insurance policy, including boiler and machinery insurance, in the amount of the Contract Value, plus value of subsequent Contract modifications, comprising total value for the entire Project at the site on a replacement cost basis, except for flood, which shall be a minimum of $50,000,000. Coverage shall insure against the perils including, but not limited to, of fire, (with extended coverage) and physical loss or damage including, lightning, collapse, earthquake, wind storm, hurricane, hail, explosion, riot, civil commotion, sprinkler leakage, civil authority, sonic boom, smoke, aircraft, land vehicles, theft, vandalism, malicious mischief, falsework, testing and start-up, temporary buildings, debris removal including demolition occasioned by enforcement of any applicable legal requirements, and all other perils, and shall include materials stored on-site, off-site and in transit. Owner shall be a named insured under the policy, and the insurance shall also include the interests of General Contractor, subcontractors, and sub-subcontractors and shall include coverage with limits of not less than $500,000 for Architect’s and Construction Manager’s services and expenses required as a result of such insured loss. If this policy excludes Employee Theft or Dishonesty coverage, including third parties, General Contractor shall obtain separate coverage with limits not less than $500,000 and deductible of not more than $50,000. For any claim made against the builder’s risk/all risk insurance, the deductible, shall not exceed the following:
    .1 builder’s risk: $25,000;
    .2 flood: excess NFIP; or
    .3 named windstorm: maximum: $250,000.
8. Each Offeror by making his Proposal represents that his Proposal includes only material and equipment specified in the Proposal Documents and supplemented, if necessary, for a complete and operating system.
9. Where subcontract work is involved and where Acceptable Subcontractors are designated for particular sections or phases of the Work, each Offeror by making his Proposal represents that his Proposal includes only firms designated as Acceptable Subcontractors.
10. That no asbestos PCBs or lead building materials shall be used, and that each Offeror (and sub-offeror or supplier submitting a proposal to an Offeror) shall submit an affidavit at Project Close-out stating that no asbestos, PCB’s or lead building materials has been used on the Project.

1.3 PROPOSAL DOCUMENTS

A. Proposal Documents include the Request for Competitive Sealed Proposals, Instructions to Offerors, the Proposal Form, and the proposed Contract Documents, including any Addenda issued prior to receipt of proposals.

B. Contract Documents for the work consist of the Owner-Contractor Agreement, the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, the Specifications, and all Addenda issued prior to receipt of proposals.

1.4 PROPOSAL PROCEDURES

A. A proposal is invalid if it has not been received at the designated location prior to the time and date for receipt of proposals indicated in the Request for Competitive Sealed Proposals, or prior to any extension thereof issued to the Offerors by Addenda.

B. All requested Alternates shall be proposed. If no change in the Base Proposal is required, enter "No Change".

C. Prior to the receipt of Proposals, Addenda will be forwarded by the Architect and will be available for inspection wherever the proposal documents are kept available for that purpose.

D. Proposals will be received in duplicate only, alongside a digital copy, on the Owner's Form of Proposal for the work as indicated by the Proposal Documents, filled in, and enclosed in a sealed envelope addressed as follows:

Name of Offeror (General Contractor)
Middle School 8
Lamar Consolidated Independent School District
Attn: Brandi Pittman, LCISD Director of Purchasing and Materials Management
Purchasing Department, 4901 Avenue I, Rosenberg, Texas 77471

E. The Proposal Form must be accompanied by Proposal Bond or Certified Check in the amount of 10% of the proposal.

F. All proposals must be delivered sealed to the above address at or before the time and date set. Proposals will be received at no other place. If Proposal is sent by U.S. Mail, it must be sent Registered Mail.

G. A proposal may be withdrawn only upon request by the Offeror or his duly authorized representative, provided such request is received by the Owner at the place designated for receipt of proposals and prior to the time fixed for the opening of proposals. A withdrawal of a proposal shall not be effective unless a written confirmation of the withdrawal is received by the Owner at said place within 48 hours before the time fixed for the opening of proposals. The Proposal Bond will be returned with the proposals if withdrawn in accordance with the above. The withdrawal of a proposal does not prejudice the right of the Offeror to file a new proposal at the time and place stated. No proposal may be withdrawn after the time fixed for the opening of proposals for a period of 30 days.

1.5 INTERPRETATION OF PROPOSAL DOCUMENTS

A. Offerors and sub-offerors requiring clarification or interpretation of the Proposal Documents shall make a written or verbal request which shall reach the Architect at least ten (10) days prior to the date for receipt of proposals.

B. Any interpretation, correction or change of the Proposal Documents will be made by Addendum. Interpretations, corrections or changes of the Proposal Documents made in any other manner will not be binding.

1.6 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

A. The materials, products and equipment described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an addendum as a substitution prior to the submission of proposals.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least seven (7) days prior to the date for receipt of proposals as described in Section 01 25 13 – Products and Substitutions. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the

proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

C. If the Architect approves any proposed substitution prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

D. No substitutions will be considered after the Contract award.

1.7 REJECTION OF PROPOSALS

A. The Owner shall have the right to reject any or all proposals and to reject a proposal not accompanied by any required proposal security, or by other data required by the Proposal Documents, or to reject a proposal which is in any way incomplete or irregular.

B. The Owner reserves the right to reject any or all proposals and to waive any formalities or irregularities and to make the award of the contract in the best interest of the Owner.

C. The Owner reserves the right to reject any proposal if the evidence submitted by, or investigation of, such offeror fails to satisfy the Owner that such offeror is properly qualified to carry out the obligations of the contract and to complete the work therein. Award may be made to other than the low-dollar offeror and given the one offering the “best value” to the school district, in addition to the purchase price, based on the published selection criteria and on its ranking evaluation.

D. Do not submit voluntary alternates. The Owner reserves the right to reject any proposal which is accompanied by conditional or qualifying statements, or “voluntary alternates”.

1.8 INSURANCE

A. Each Offeror shall include in his proposal the complete cost and shall carry and keep in full force for the duration of the project, insurance coverage required under the General Conditions and Document CB - Supplementary Conditions.

1.9 PERFORMANCE BOND AND PAYMENT BOND

A. Each Offeror shall include in this proposal the premium costs for 100% Performance Bond and 100% Payment Bond. These bonds shall cover the faithful performance of the contract and payment of all obligations arising thereunder in such form as the Owner may prescribe. The bonding companies must be acceptable to the Owner. The selected Offeror shall deliver the required bonds to the Owner not later than the date of execution of the Contract.

1.10 PROPOSAL SECURITY

A. No proposal will be considered unless it is accompanied by a Certified or Cashier's Check or Proposal Bond executed on the form attached. In either case the amount shall be not less than ten percent (10%) of the greatest amount proposed (considering alternates, if any). The proposal security shall insure the execution of the contract and the furnishing of an acceptable Performance Bond and Payment Bond by the successful Offeror within ten (10) days after notification of award to such Offeror and that this proposal will not be withdrawn within 30 days after date of opening of proposals without the consent of the Owner. Proposal Bond shall be prepared in the identical form of AIA Document A310 or the form attached.

1.11 SUBMISSION OF POST PROPOSAL INFORMATION

A. The apparent Selected Offeror shall within one (1) day after proposals are received submit the following:

1. A designation of the work to be performed by the Offeror with his own forces.
2. An experience profile of the selected Offeror's superintendent scheduled to work on this project. In addition, the apparent selected Offeror shall cooperate with the Owner, supplying requested information to substantiate the qualifications of the superintendent. If, in the opinion of the Owner, the superintendent does not qualify, the Owner may request the submission of another superintendent and more information. The Owner reserves the right to reject the apparent selected Offeror if an acceptable superintendent is not presented.

B. The Selected Offeror shall within five (5) days thereafter submit the following:
1. A statement of costs for each major item of work included in the proposal as described in Section 01 29 73 – Schedule of Values. Each section of specifications will be considered a major item of work and shall be shown as a separate cost item.
2. A schedule of all project submittals, organized by specification division, that will be issued for review by the Architect. This submittal schedule must include the dates that each submittal will be issued to the Architect for review. Listed submittal issue dates must correlate with submitted construction schedule and must account for lead times for material procurement and installation. In the instance that multiple submittals are issued for Architect review on the same date, this submittal must designate the order in which the contractor would prefer the submittals to be returned in.

1.12 AWARD OF CONTRACT

A. The Offeror to whom the award is made will be promptly notified. If an Offeror (a) withdraws his proposal within 30 days after the date of time fixed for the opening of proposals in the Request for Competitive Sealed Proposals, or (b) fails or refuses to execute the Agreement, or other required forms within ten (10) days after the same are presented to him for signature, or (c) fails or refuses to furnish properly executed Performance Bond and Certification of Required Insurance within 15 calendar days of execution date of the Agreement, the Owner may award the work to another Offeror or Offerors or may call for new proposals.

B. The Offeror will be required to (a) submit his Proposal and Proposal Bond, (b) execute Contract and Performance and Payment Bonds, and (c) submit Certification of required insurances, all using the Owner's own forms for such respective purposes.

C. Proposal Bond is forfeited if proposal is withdrawn after the proposal opening, or Contract Documents are not executed in accordance with the above.

1.13 NOTICE TO PROCEED

A. The Offeror shall not commence work under this Contract until he receives the written Notice to Proceed, or the Contract is duly signed by the Owner.

1.14 COMPLETION TIME

A. Offerors shall familiarize themselves with the Owners requirements concerning the project schedule as described in Section 01 32 00 of this Project Manual.

B. Having thoroughly familiarized himself with the conditions as they exist at the building sites and acquainted himself with the labor supply and the material market, the Offeror will state in his proposal that he agrees to be substantially complete with the work by the date stated above.

C. It is therefore expressly agreed as a part of the consideration inducing the Owner to execute this contract that the Owner may deduct liquidated damages from the final payment made to the Contractor for each and every calendar day beyond the agreed date which the Contractor shall require for Substantial Completion of the work included in this contract. It is expressly understood that the said sum per day is agreed upon as a fair estimate of the pecuniary damages which will

be sustained by the Owner in the event that the work is not completed within the agreed time, or within the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty, said damage being caused by additional compensation to personnel, for loss of interest on money and other miscellaneous increased costs, all of which are difficult of exact ascertainment. Also, any disruption of Owner's use of the existing facilities or newly completed facilities will also be subject to liquidated damages. Refer to Section 01 32 16 for additional requirements. Delays, disruption of use, failures to complete, and liquidated damages are fully described under Article 8.3 of the Supplementary Conditions.

The definition of Substantial Completion is found in Article 9.8.1 of the AIA General Conditions and Supplementary Conditions bound herein.

1.15 FELONY CONVICTION NOTIFICATION

A. Section 44.034, of the Texas Education Code requires a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony. Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract." Subsection (c) states "this section does not apply to a publicly held corporation."

B. The Offeror **must** execute Statement of Affirmation and submit with proposal.

1.16 LIST OF SUBCONTRACTORS

A. The Offeror shall supply a list of the following major:
1. Mechanical
2. Electrical
3. Plumbing
4. Masonry
5. Concrete
6. Steel
7. Any other prudent subcontractor.

B. The Offeror **must** execute Document 00 40 12, List of Subcontractors and submit with their Proposal.

1.17 AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

A. The Offeror, and sub-offerors, shall agree to refrain from discrimination in terms and conditions of employment to the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and Rules and Regulations issued in order to maintain and insure non-discriminatory employment practices.

B. The Offerors **must** execute Document 00 40 13, Affidavit of Non-Discriminatory Employment and submit with Proposal. The sub-offerors shall execute Document 00 40 13, Affidavit of Non-Discriminatory Employment before commencing work on this Project. Offerors and sub-offerors who have not executed this document will not be eligible to work on this project.

1.18 AFFIDAVIT OF NON-ASBESTOS, LEAD, AND PCB USE IN PROJECT

A. The use of any construction process or the installation of any asbestos, lead and PCBs or material containing asbestos, lead and PCBs is strictly prohibited for this Project.

B. Prior to submitting a proposal, Offerors shall notify the Architect, in writing, of any materials in these specifications which are known to contain or are likely to contain asbestos, lead or PCBs.

C. The Offeror, and sub-offerors shall agree to refrain from using products which are known to contain asbestos, lead, and PCB containing materials as applicable to the project. They shall also affirm that lead or lead bearing materials have not been incorporated into potable water systems, and that lead sheet flashing used in through roof plumbing penetration applications is the only lead on the Project.

D. The Selected Offeror (Contractor) **must** execute Document 00 40 13, Affidavit of Non-Asbestos, Lead, and PCB Use and submit at Project Closeout. The Subcontractors to the Contractor **must** execute Close-out Form "D", attached to section 01 77 00, Subcontractors Hazardous Material Certificate and submit at Project Closeout.

1.20 CONFLICT OF INTEREST QUESTIONNAIRE

A. According to Local Government Code, Chapter 176, a person or an agent of a person who contracts or seeks to contract for the sale or purchase of property, goods, or services with any government agency must file a completed Conflict of Interest Questionnaire with the records administrator of the local government not later than the seventh business day after the date that the person begins contract discussions or negotiations with the District or submits to the District an application, response to a request for proposals or bids, correspondence, or another writing related to a potential agreement with the District.

B. All Offeror's and sub-offeror's proposing to do work with the District **must** execute Document 00 40 18, Conflict of Interest Questionnaire and submit to the District's Legal Department within seven (7) days of the Proposal Date. This requirement will be waived if the Offeror or sub-offeror has previously submitted such document to the District within the last year. In such case, provide written notification and attach to the Proposal.

1.21 CRIMINAL HISTORY RECORDS

A. Prior to commencing any work on this Project, the Selected Contractor shall certify, on the form provided herein as Document 00 40 17, that for each of its employee who will have direct contact with students, the Selected Contractor has obtained, as required by Texas Education Code Section 22.0834:
   1. national criminal history record information from a law enforcement or criminal justice agency for each employee of the Selected Contractor hired before January 1, 2008 who will have direct contact with students; and
   2. national criminal history record information from the Texas Department of Safety for each employee of the Selected Contractor hired on or after January 1, 2008 who will have direct contact with students; Fingerprinting is required and shall be provided by the contractor (applicant) and administered through FAST (Fingerprint Applicant Services of Texas) which will be recorded by the District in the FACT (Fingerprint-based Applicant Clearinghouse of Texas). Currently applicant must obtain fingerprinting from L-1 Identity Solutions Company, (888) 467-2080, or schedule an appointment online at: https://tx.ibtfingerprint.com/.

B. Any personnel who will have direct contact with students must not have been convicted of an offense identified in Texas Education Code Section 22.085.

C. At this time, Senate Bill 9 applies only to contractors with direct contracts with the District. This requirement does not apply to sub-contractors of the Contractor, material suppliers, or a one-time

service provider such as a service technician, delivery person, testing agent, code official, or similar personnel. However, changes to these requirements are anticipated and may require the acquisition and submittal of additional background checks to the District during the course of the Work.

D. The Selected Contractor shall execute and submit Document 00 40 17, Certification of Criminal History Record Information Review by Contractor-Employer along with required Schedule 'A' documenting proposed employees to be working on site, within 10 days after receipt of Notice To Proceed and prior to commencement of Work.

E. Furthermore, an updated Schedule 'B' shall be submitted weekly to the District indicating changes to contractor personnel with accompanying certifications and criminal history records. Any fingerprinting and photographing required by the aforementioned code will be the responsibility of the Contractor-Employer.

1.22 AVAILABILITY OF MATERIALS AND SYSTEMS

A. A serious effort has been made to select only materials that are systems that are readily available. As far as is known at proposal time all items are either available "off the shelf" or within a relatively short period of time. If during the proposal period, an Offeror becomes aware of an availability or delivery problem with any of the specified systems or materials, he should notify the Architect immediately. The Architect will promptly explore possibilities for selecting other systems or materials which would circumvent the problem and notify Offerors of any changes in an addendum, otherwise it will be understood that only specified systems and materials that are readily available are included in the proposals.

1.23 DETERMINATION OF SUCCESSFUL RESPONDENT AND AWARD OF CONTRACT

A. In determining the Selected Offeror, the Owner will evaluate the information derived from the Offeror's (Contractor's) Qualification Statement required herein, the information submitted on the Proposal Form, and other selection criteria including, but not be limited to the following:

B. The Selection Committee consisting of The District's administrators, program managers, architects, consultants and other staff will make an initial evaluation of the proposals. The committee's recommendation will be considered by the District's Board of Trustees ("Board"). The District reserves the right to review the recommendation with the Director of Maintenance and Operations and others deemed appropriate by the District prior to review by the entire Board. The final decision-making authority on the proposals rests with the full Board. Decision-making authority has not been delegated to any person or entity other than the Board.

C. The District will make such investigations as it deems necessary to determine the ability of the offeror to perform the Work, and the offeror shall furnish all such information and data for this purpose as may be requested. The District reserves the right to reject any proposal if the evidence submitted by, or investigation of, such offeror fails to satisfy the District that such offeror is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein.

D. The District reserves the right to reject any or all proposals and to waive any formalities or irregularities and to make the award of the contract in the best interest of the District.

E. A decision regarding determination of the successful Offeror will be made by the District as soon as practical.

1.24 USE OF ASBESTOS FREE MATERIALS, PRODUCTS AND SYSTEMS

A. The Offeror is reminded to refer to the Paragraph above for requirements during the Proposal period and the following requirements during performance of the Work regarding the use of asbestos free materials, products and systems in the Project.
   1. Since many materials, products and systems are proprietary, it is not possible to know all of the materials or components which go into producing such material, product or system without the manufacturer divulging trade secrets or patent information. Every effort has been made to specify materials, products or systems, which either as an "off the shelf" material, product or system or as a custom material, product or system do not contain asbestos.
   2. It is the Contractor's responsibility to submit an affidavit from the manufacturer to ascertain that every material, product or system used in the Project does not contain asbestos. In the event the material, product or system is found to contain asbestos, the Contractor shall offer for the Architect's consideration a substitution which he knows does not contain asbestos.
   3. Even though a material, product or system is specified or a specification is based on a particular material, product or system, the Contractor will not be relieved from the responsibility to ascertain that materials, products and systems used in the Project do not contain asbestos. Under no circumstances shall a material, product or system which is known, suspected or found to contain asbestos be used on the Project.
   4. If a material, product or system containing asbestos is used, the Contractor shall remove and replace the material, product or system with one which is asbestos free at no additional expense to the Owner, including removal and replacement of other materials affected by the removal of the asbestos bearing material, product or system, i.e. gypsum wallboard removed, replaced, and repainted on account of insulation being removed, etc.

1.25 COMPLIANCE WITH GOV'T CODE 552.372

A. The requirements of the Texas Public Information Act, Chapter 552 of the Texas Government Code, Subchapter J, may apply to this bid or contract if it is valued at more than $1 million. The contractor or vendor agrees the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter, including the preservation of all "contracting information" (as defined in 552.003) and the provision, upon request of the governmental entity with whom you are contracting, of all contracting information. Contracting information includes, but is not limited to, records, communications and other documents related to the bid process, contract, payments, receipts, scope of work/services, and performance.

END OF DOCUMENT 00 20 00

SECTION 00 31 32 - GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 GEOTECHNICAL REPORT

A. Geotechnical Report: A report of a geotechnical investigation entitled LCISD Middle School No. 8 Geotechnical Engineering Report, Brookshire, Texas, project number 92255217, dated August 26, 2025, has been prepared for Lamar Consolidated Independent School District , Fort Bend County, Texas by the Geotechnical Consultant, Terracon Consultants, Inc, Houston, Texas (713) 690-8989, based on soil boring samples obtained at the Project site on September 7, 2023, through July 8, 2025.

B. Boring Logs: Excerpts from the Geotechnical Report, including a Boring Plan, Boring Logs describing strata for each test hole, and results of laboratory tests, are bound herein, or if not bound herein, will be made available to Offerors by the Owner upon request.

C. The Drawings and Specifications govern the construction of the Project. Boring Logs and the Geotechnical Report are made available for the information and convenience of Offerors. The findings and recommendations are the responsibility of the preparer, and are not part of the Contract Documents.

1.2 SUBSURFACE CONDITIONS

A. Subsurface conditions indicated in the report were found to exist at the locations shown on the dates the samples were taken and the tests performed. Since subsurface conditions, including but not limited to the presence of groundwater, may vary significantly from time to time, no representation or warranty is made that the conditions described in the Geotechnical Report describe the actual conditions that will be extant during the performance of the Work of This Contract.

B. Offerors shall visit the site and become fully acquainted with the conditions affecting the Work of This Contract.

PART 2 - PRODUCTS *(Not Used)*

PART 3 - EXECUTION *(Not Used)*

END OF SECTION 00 31 32

LCISD Middle School No.8

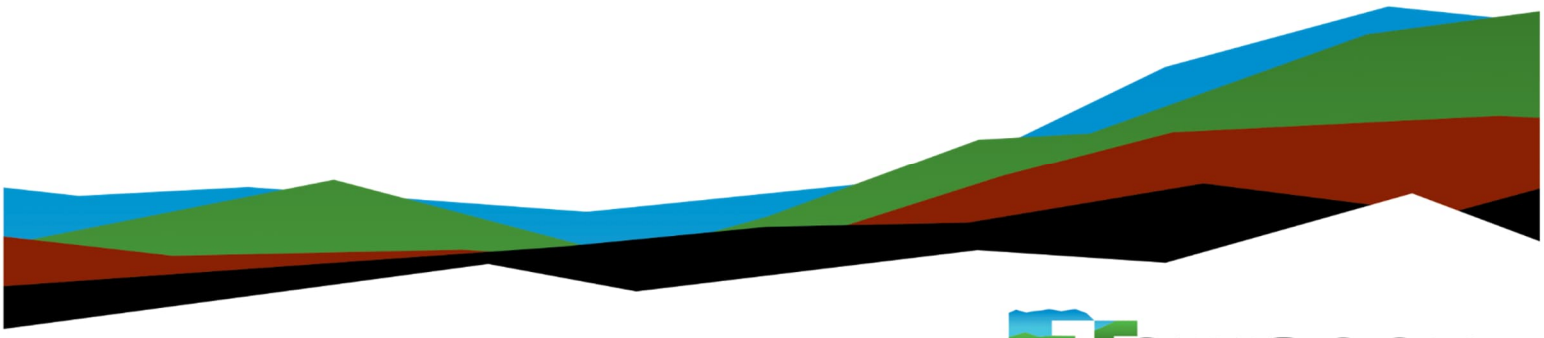
Geotechnical Engineering Report

Brookshire, Texas

August 26, 2025 | Terracon Project No. 92255217.Revision1

Prepared for:

Lamar Consolidated Independent School District
3911 Avenue I
Rosenberg, Texas 77471



Terracon
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- Facilities
- Environmental
- Geotechnical
- Materials

11555 Clay Road, Suite 100
Houston, Texas 77043
P (713) 690-8989
Terracon.com

August 26, 2025

Lamar Consolidated Independent School District
3911 Avenue I
Rosenberg, Texas 77471

Attn: Mr. Scot Hartfiel, AIA
Design Manager

Re: Geotechnical Engineering Report
LCISD Middle School No.8
Farm to Market Road 359 and Twinwood Parkway
Brookshire, Texas
Terracon Project No. 92255217.Revision1

Dear Mr. Hartfiel:

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the project referenced above in Brookshire, Texas. We trust that this report is responsive to your project needs.

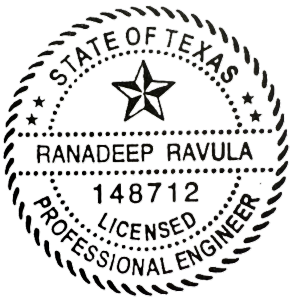
We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.
(Texas Firm Registration No.: F-3272)

For: Jonathan N. Han, E.I.T.
Senior Staff Engineer

Ranadeep Ravula, P.E.
Group Manager



Kierstyn M. Burrell, P.E.
Geotechnical Services Manager

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Exploration and Laboratory Results
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Note: This report was originally delivered in a web-based format. Blue Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

Refer to each individual Attachment for a listing of contents.

Introduction

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the proposed construction of a new middle school campus at a site located near the intersection of Farm to Market 359 and Twinwood Parkway in Brookshire, Texas. This project was authorized by Mr. Kevin McKeever, Executive Director of Lamar Consolidated Independent School District (LCISD) through issuance of Purchase Order No. 74011062, dated June 3, 2025. This project was performed in general accordance with Terracon Document No. P92255217, dated May 8, 2025.

The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Boring logs with field and laboratory data;
- Groundwater levels observed during drilling;
- Site Location and Exploration Plans;
- Subsurface exploration procedures;
- Description of subsurface conditions;
- Earthwork recommendations including site/subgrade preparation;
- Foundation design parameters and construction recommendations;
- Recommendations for design and construction of floor slabs;
- Utility construction considerations;
- Uplift and lateral earth pressures;
- Temporary groundwater control and excavation considerations;
- Seismic site class (based on IBC 2021); and
- Pavement design guidelines.

The geotechnical engineering Scope of Services for this project included the advancement of 17 test borings, laboratory testing, engineering analysis, and preparation of this report.

Terracon previously performed a Preliminary Geotechnical Report (Terracon Project No. 92235414, dated October 4, 2023 at this site for Kaluza, Inc. We understand this report has been released to LCISD. We utilized the available field and laboratory information to help provide our geotechnical engineering recommendations for this project.

Maps showing the site and boring locations are shown on the Site Location and Exploration Plan, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs in the Exploration and Laboratory Results section.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration.

Item	Description
Project Location	The project is located approximately ½-mile southwest from the intersection of Farm to Market Road 359 and Twinwood Parkway in Brookshire, Texas. See Site Location.
Existing Improvements	The site was vacant at the time of our field exploration program.
Current Ground Cover	Grass, weeds, and scattered trees.
Existing Topography	Relatively level.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Proposed Improvements[1]	■ A single-story middle school building with up to two second-story mezzanines with a footprint area of approximately 103,000 square feet. ■ New storm, sanitary sewer, and water utilities to be installed within the proposed pavement areas. The maximum depth of utilities is planned to be 15 feet. The utilities will be placed using open-cut construction methods and will be designed and constructed in accordance with Fort Bend County guidelines. ■ Associated surface pavements and driveways for the middle school campus.
Building Construction[1]	Either steel-frame or concrete masonry unit (CMU) construction with a grade-supported floor slab.
Finished Floor Elevation (FFE)	Based on information provided to us by Kaluza, Inc., we understand FFE is +153.00 feet, which is approximately 1 to 2 feet above existing grade.

Item	Description
Maximum Loads[1]	■ Total Column Loads: Up to 350 kips ■ Sustained Column Loads: Up to 265 kips ■ Walls: 2 to 4 kips per linear feet (klf) ■ Floor Slab Pressure: 125 pounds per square foot (psf)
Planned Foundation Systems[1]	Either drilled-and-underreamed footings or drilled straight shafts.
Pavements	We assume both rigid (concrete) and flexible (asphalt) pavement sections are being considered.
Anticipated Traffic	Consists primarily of passenger vehicles in the parking areas and passenger vehicles combined with garbage trucks and large multi-axle delivery trucks/buses from time-to-time in driveway areas.

1. Based on the information provided by Kubala Engineers on August 5, 2025.

Geotechnical Characterization

Geology

Based on the geologic maps published by the Bureau of Economic Geology, the site for the proposed project is located on the upper Lissie formation, sometimes denoted the Montgomery formation. The upper Lissie formation is heterogeneous, containing interbedded layers of clay, sand and silt. This formation was deposited in mid-Pleistocene time in shallow coastal river channels and flood plains.

The clay present in the formation has been preconsolidated by a process of desiccation. Numerous wetting and drying cycles have produced a network of randomly oriented and closely-spaced joints, which are sometimes slickensided, that is, have a shiny appearance when exposed. The joint pattern strongly influences the engineering behavior of the soil.

The sand layers vary in compactness from loose to very dense, and in thickness from a fraction of an inch to many feet due to an irregular depositional environment. Sands are generally subrounded to subangular and vary from coarse to very fine, are poorly graded, and often contain significant amounts of silt-sized particles in the sand matrix.

The coastal plain in this region has a complex tectonic geology, several major features of which are: Gulf Coastal geosyncline, salt domes, and major sea level fluctuations during the glacial stages, subsidence and geologic faulting activities. Most of these geologic

faulting activities have ceased for millions of years, but some are still active. A detailed geologic fault investigation and study of the site geology are beyond the scope of this report.

GeoModel

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the Exploration and Laboratory Results and the GeoModel can be found in the Figures attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Sandy Silt	dark gray, very loose to medium dense, with scattered roots and clay pockets
2	Sandy Lean Clay	dark gray, light gray, and reddish brown, very soft to hard, with silt and sand pockets, and ferrous stains
3	Fat Clay and Sandy Fat Clay	light gray and reddish brown, stiff to hard, with sand pockets, ferrous stains, and calcareous nodules
4	Clayey Sand, Poorly Graded Sand with Silt, and Silty Sand	light gray and reddish brown, loose to dense, with clay pockets

Groundwater Conditions

Boring B-1 through B-17, PB-2, and PB-3 were advanced using dry drilling techniques to a depth of approximately 20 to 30 feet in an effort to evaluate groundwater conditions at the time of our field program. Groundwater was initially observed at borings B-1 and B-17 at depths that ranged from about 20 to 23 feet during dry drilling. After a 15-minute monitoring period, groundwater was observed at borings B-1 and B-17 at a depth of about 19 feet. Groundwater was not observed at borings B-2 through B-16, PB-2, and PB-3 during or upon completion of drilling.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project and should be evaluated prior to construction.

Geotechnical Overview

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. A summary of our findings and recommendations is provided below.

- The surficial soils observed in portions of the site exhibited negligible to low plasticity and an increased silt and sand content. These soils are moisture sensitive and may become weak with elevated moisture contents and present construction difficulties. If wet and/or soft conditions are present at the time of construction, remedial efforts may be necessary for preparation of the surficial soils in the building and pavement areas to create a working surface. Remedial effort options are discussed in the Wet Weather/Soft Subgrade section of this report.

- Expansive soils were observed at this site. This report provides recommendations to help reduce the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and distress in the building should be anticipated. The severity of distress will increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement associated with expansive soils may not be feasible. However, this risk can be significantly reduced if the building is designed as a structural slab over a void space with the structural loads supported by a foundation system terminated below the active zone.

- A foundation system consisting of either drilled-and-underreamed footings or drilled straight shafts may be utilized to support the proposed building planned at this site.

- The subgrade soils tend to become very silty/sandy below a depth of about 8 to 13 feet below existing grade at borings B-1 through B-12. If underreams were attempted below the recommended bearing depth, they would likely become unstable.

- Based on the subsurface conditions observed, the installation of the drilled straight shafts will likely require the use of Slurry Displacement Method and/or temporary steel casing to help control any groundwater seepage and/or sloughing of the sidewalls.

- A minimum 48-inch thick select fill pad should be placed under the proposed building to provide uniform support to the floor slab and reduce the estimated Potential Vertical Rise (PVR) of the subgrade to approximately one inch or less.

- Based on the soil and groundwater information obtained during our field program, we anticipate that excavations for the utilities that extend into the clay soils may occur without advanced dewatering, seepage from the clay soils is expected to be minor and likely can be handled utilizing a system of sumps and pumps positioned at the bottom of the excavation. However, excavations that extend through zones of sand/silt soils such as observed at borings B-13, B-15 through B-17, PB-2, and PB-3 at depths as shallow as shallow as 10 to 13 feet below existing grade may require some form of advance dewatering, depending on the groundwater conditions at the time of construction.

- We understand that the maximum embedment depth for the proposed utilities is planned to be up to 15 feet below existing grade. Settlement should be expected in the deeper areas of backfilled soils. The potential for settlement is increased if the backfill is not properly placed and compacted. To reduce the potential of settlement, other alternatives such as backfilling with cement stabilized sand may be considered in lieu of on-site material. Terracon can provide recommendations if these alternatives are being considered.

- Rigid pavement sections vary from 5.0 to 7.0 inches of reinforced concrete with chemically treated subgrade.

- Flexible pavement sections vary from 2.0 to 2.5 inches of asphaltic concrete over 8.0 to 10.0 inches of base material with chemically treated subgrade.

This summary should be used in conjunction with the entire report for design purposes. Details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled General Comments should be read for an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of

specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slab, utilities, and pavements.

Site Preparation

Construction areas should be stripped of vegetation, topsoil, trees, and other debris/unsuitable surface material. Roots of trees to be removed within the construction areas should be grubbed to full depths. Care should be taken to replace or recompact all soil removed or loosened by the removal of tree roots and stumps as recommended in subsequent paragraphs. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

Once final subgrade elevations have been achieved, the exposed subgrade should be proofrolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Weak areas detected during proofrolling, as well as zones containing organic matter and/or debris, should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction area should be evaluated for moisture and density. If the moisture and/or density do not meet the criteria described in Fill Compaction Requirements for on-site soils, the subgrade should be scarified to a minimum depth of 6 inches, moisture adjusted, and compacted to at least 95 percent of the Standard Effort (ASTM D698) maximum dry density.

Fill Material Types

Select fill and on-site soils to be used at this site for grade adjustments should meet the following criteria:

Fill Type	USCS Classification	Acceptable Location for Placement
Select Fill Soils	CL and/or SC (10≤PI≤20)	Must be used to construct the select fill pad under the grade-supported slab and for all grade adjustments within the building area.
On-site Soils[1]	Varies	The on-site soils appear suitable for use as fill within the pavement areas, provided they are free of organics and debris.

Fill Type	USCS Classification	Acceptable Location for Placement

1. The utilization of on-site silt/sand soils may present difficulties during construction due to the increased sand and silt content of these soils, especially during and soon after periods of wet weather. If the utilization of the silt/sand soils as fill is planned in the pavement areas, treatment of these soils with lime-flyash should produce a material that would be more suitable for use as fill.

If blended or mixed soils are intended for use as select fill, Terracon should be contacted to provide additional recommendations. Blended or mixed soils do not occur naturally. These soils are a blend of sand and clay and will require mechanical mixing at the site with a pulvimixer. If these soils are not mixed thoroughly to break down the clay clods and blend-in the sand to produce a uniform soil matrix, the fill material may be detrimental to the performance of the foundations. If blended soils are used, we recommend that additional samples of the blended soils as well as the clay clods, be obtained prior to and during earthwork operations to evaluate if the blended soils can be used in lieu of select fill. The actual type and amount of mechanical mixing at the site will depend on the amount of clay and sand, and properties of the clay.

Fill Compaction Requirements

Item	Description
Fill Lift Thickness	The fill soils should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches.
Compaction Requirements	■ The select fill and on-site soils should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The select fill soils should be moisture adjusted to within 2 percent of the optimum moisture content. ■ The on-site clay soils should be moisture conditioned to between optimum and +4 percent of the optimum moisture content.

Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.

Utility Trench Backfill

Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building. We recommend constructing an effective clay “trench plug” that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted at a water content at or above the soils optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction. Water permitted to pond next to the building can result in distress in the building. These greater movements can result in unacceptable differential floor slab movements, cracked slabs and walls, and roof leaks. Building slab and foundation performances described in this report are based on effective drainage for the life of the structures and cannot be relied upon if effective drainage is not maintained.

Exposed ground should be sloped away from the building for at least 10 feet beyond the perimeter of the building. After building construction and landscaping, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the building should also be periodically inspected and adjusted as necessary, as part of the building’s maintenance program.

Planters located within 10 feet of the proposed building should be self-contained to prevent water accessing the building and pavement subgrade soils. Locate sprinkler mains and spray heads a minimum of 5 feet away from the building lines. Low-volume, drip-style landscaped irrigation should not be used near the building. Collect roof runoff in drains or gutters. Discharge roof drains and downspouts onto pavements and/or flatworks which slope away from the proposed building or extend down spouts a minimum of 10 feet away from building.

Flatworks and pavements will be subject to post construction movement. Maximum grades practical should be used for paving and flatwork to prevent water from ponding. Allowances in final grades should also consider post-construction movement of flatwork, particularly if such movement would be critical. Where paving or flatwork abuts the building, effectively seal and maintain joints to prevent surface water infiltration.

Wet Weather/Soft Subgrade Considerations

Due to the elevated silt and sand content and negligible to low plasticities of the surficial soils observed at this site, proper compaction may be difficult to achieve. In addition, construction during and soon after wet weather periods may encounter difficulties due to wet and soft surficial soils becoming a general hindrance to equipment as a result of rutting and/or pumping of the soil surface. This condition is primarily due to their lack of cohesion (low clay content) and little to no confining pressure near the ground surface. If the subgrade cannot be adequately compacted to the minimum densities as described above, one of the following methods should be used to improve the soils: 1) removal and replacement with select fill, 2) chemical treatment of the soil to dry the subgrade, or 3) drying by natural means if the schedule allows.

Based on our experience with similar soils, chemical treatment is an efficient and effective method to improve the condition of wet and soft subgrade such as that observed at this site. Chemical treatment may be necessary to depths of approximately one to 2 feet or greater of the surficial silty/sandy soils, depending on the condition of the subgrade at the time of construction. We suggest that a cost be included in the construction budget for chemical treatment of the soils using a lime-flyash mixture to aid drying and improve the condition of the soil if the soil is wet and/or soft at the time of construction. We recommend that this cost be in the form of a contingency or allowance to be used if needed.

Foundation Systems

Based on information provided by Kubala Engineers on August 5, 2025, a foundation system consisting of consisting of either drilled-and-underreamed footings with a grade-supported slab system or drilled straight shafts may be utilized to support the proposed building planned at this site, provided the subgrade is properly prepared as described in this report. Recommendations for these types of foundation systems are provided in the following sections, along with other geotechnical considerations for this project.

Design Recommendations – Drilled-and-Underreamed Footings

Item	Description
Minimum Embedment Depth [1]	9 feet below final grade
Allowable Bearing Pressures [2]	Net dead plus sustained live load – 3,600 psf Net total load – 5,400 psf
Maximum Underream-to-Shaft Diameter Ratio	3:1

Item	Description
Minimum Underream-to-Shaft Diameter Ratio [3]	2:1
Estimated Uplift Pressure Due to Post-Construction Heave of the Clay Soils [4]	1,000 psf
Minimum Percentage of Steel [5]	0.5 percent
Approximate Post-Construction Settlement [6]	One inch or less
Estimated Differential Settlement [7]	Approximately ½ of post-construction settlement
Allowable Passive Pressure [8]	1,000 psf
Uplift Resistance [9]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should bear within the native undisturbed clay soils.
1. Whichever condition yields a larger bearing area.
2. This minimum underream-to-shaft diameter ratio should result in a large enough diameter of the underream to overcome uplift forces on the footing without causing local soil failure to the overlying soils.
3. The magnitude of uplift is difficult to predict and will vary with in-situ moisture contents. This uplift pressure can be approximated over the entire perimeter of the shaft above the top of the underream.
4. The footings should contain sufficient vertical reinforcing steel throughout the entire shaft length to resist uplift (tensile) forces due to post-construction heave of the clay soils. The amount of reinforcing steel required can be computed by assuming that the dead load of the structure surcharges the footing, that the above estimated tensile force acts vertically on the shaft, and that the underream acts as a rigid anchor.
5. This estimated post-construction settlement of the drilled-and-underreamed footings is without considering the effect of stress distribution from adjacent foundations and assuming proper construction practices are being followed. A clear distance between the footings of one underream diameter of the larger footing should be provided between the underreams to develop the recommended bearing pressures and to control settlements. If a clearance of one diameter cannot be maintained in every case, the above bearing capacities should be reduced by 20 percent for a clearance between one half and one underream diameters. Underreams closer than a clearance of one half of an underream diameter are not recommended.
6. The differential settlement will result from variances in subsurface conditions, loading conditions and construction procedures, such a cleanliness of the bearing area or flowing water in the shaft.
7. For footings placed against an undisturbed vertical face of the in-situ soils. Lateral resistance of the drilled-and-underreamed footings is primarily developed by passive resistance of the soils against the side of the footing. Due to surface effects and the presence of expansive soils, the lateral resistance of the upper 4 feet of the soils at the surface for exterior footings should be neglected unless area paving is provided up to the edge of the building.

Item	Description
8.	Structural uplift loads on the drilled-and-underreamed footings will be resisted by the dead weight of the footings and supported structure plus the weight of a soil wedge above the footing. The soil wedge can be assumed to extend upward from the bottom of the underream at a slope of 4 vertical to 1 horizontal.

Construction Considerations – Drilled-and-Underreamed Footings

Drilled excavations to a depth of 9 feet below final grade will be necessary for installation of drilled-and-underreamed footings for the proposed buildings planned at this site. The excavations should be performed with equipment capable of providing a relatively clean bearing area. The presence of secondary structures such as sand pockets, ferrous stains, etc., can cause sloughing during footing excavation. Thus, the drilling contractor should have casing available in the event that sloughing causes improperly formed shafts.

Based on our groundwater observations (refer to Groundwater Conditions), groundwater is not expected to be a major concern during construction at the recommended bearing depth. However, depending on climatic conditions, groundwater levels may vary from the levels observed during our field program. Water must not be allowed to accumulate in the bottom of the footing excavations. The contractor should be prepared to remove water from the drilled footings, if necessary. To reduce the potential for water seepage into the footing excavation and to minimize disturbance to the bearing area, we recommend that concrete and steel be placed as soon as possible after footing excavations are completed. Preferably, footing excavations should be backfilled with concrete within about 2 to 4 hours of completion of the drilling and in no case should an excavation be left open overnight. The concrete placed in the excavations should have a 6-inch slump with a plus or minus one inch tolerance. The bottom of each footing excavation should be free of all loose materials and/or water, and the bearing surface should be evaluated immediately prior to placing concrete.

Additionally, the subgrade soils tend to become very silty/sandy below a depth of about 8 to 13 feet below existing grade at borings B-1 through B-12. If underreams were attempted below the recommended bearing depth, they would likely become unstable. In addition, significant groundwater seepage could occur. Thus, we recommend the footing depths not be lowered below the recommended bearing depth without discussion and consideration of the consequences. The contractor should not auger the shaft deeper than the recommended bearing depth under any circumstances without contacting us.

Based on the available field and laboratory data, the underreams constructed as described in this report should remain stable for a short period of time. However, if underreams are marginally stable due to water seepage and/or the presence of sloughing soils, successful construction of underreamed footings may be possible by

performing the sequence of construction without interruption, that is, each footing drilled, underreamed, and backfilled with concrete in one continuous operation. The contractor must coordinate the operation very closely to have concrete on site at the time each footing is drilled and underreamed so that no shaft or underream is drilled without concrete standing by, ready to be placed. Additional measures to reduce the potential for caving of the underream would be to limit the underream-to-shaft diameter ratio to 2.5:1 or 2:1 or to install straight shaft footings in isolated problem areas. If straight-shaft footings are planned at the site, Terracon should be contacted for additional recommendations.

Grade Beams – Drilled-and-Underreamed Footings

Grade beams associated with the drilled-and-underreamed footings and a grade-supported floor slab should be designed to span between the footings without subgrade support. We understand the grade beams are planned to be constructed without a void space. However, due to the underlying clay soils, nominal upward movement of the grade beams may occur during moisture variations of the subgrade.

Backfill against the outside face of the grade beams should consist of select fill used to prepare the building pad. The select fill should be uniformly compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 2 percent of optimum moisture content.

Design Recommendations – Drilled Straight Shafts

The drilled straight shafts planned for the proposed school building should be designed to resist both horizontal and vertical forces. Horizontal forces can be resisted by the passive pressure of soil acting on the vertical face of the drilled straight shafts. Vertical downward forces can be resisted by the allowable end bearing pressure of the soils at the bottom of the drilled straight shafts. Vertical uplift forces can be resisted by the dead weight of the poles and its foundation. When foundation concrete is cast in direct contact with excavation sides, an allowable side friction value can also be used to resist vertical loads.

The allowable design criteria for utilization of drilled straight shafts as the foundation system for the proposed school building are presented in the following table. The table includes the effective soil unit weights, shear strength parameters, allowable end bearing pressure, lateral passive pressure and side friction values. Furthermore, the lateral subgrade modulus values are provided for the cyclic and static loading conditions. Care should be exercised to utilize the appropriate loading condition in the analysis.

The design parameters presented in the following tables are applicable for the natural, undisturbed soils. The design parameters provided were calculated assuming groundwater is below 20 feet.

Long-term settlement of the drilled straight shaft foundation, designed and constructed in accordance with the recommendations presented in this report, should be about one inch or less.

Design Parameters for Drilled Straight Shaft Footings		
Below Existing Grade (feet) [1]	Allowable Unit Skin Friction Resistance[2] (psf)	Allowable End Bearing Pressure[3] (psf)
0 to 4	Disregard	
4 to 10	550	Disregard
10 to 20	400	6,000
20 to 23	600	6,000
23 to 30	550	6,000

1. Grade at the time of our field program.
2. The allowable side friction is based on a rectangular pressure distribution.
3. The net allowable end bearing pressure refers to the pressure at the foundation bearing level in excess of the surrounding overburden pressure. A minimum penetration of 2 feet or one-half a shaft diameter, whichever is greater, into the desired bearing strata should be achieved with a minimum of 4 feet of the selected bearing stratum beneath the shaft tip to use the recommended allowable end bearing pressure.

LPILE Parameters for Drilled Straight Shaft Footings						
Soil Classification	Below Existing Grade[1] (feet)	Effective Unit Weight (pcf)	Lateral Subgrade Modulus	Strain ε_{50} (in/in)	Undrained Shear Strength (psf)	Angle of Internal Friction (degree)
Fat Clay (CH)	0 to 4	125	---	0.002	250	---
Lean Clay (CL)	4 to 10	125	---	0.007	2,000	---
Silty Sand (SM)	10 to 20	120	90	---	---	32
Silty Sand (SM)	20 to 23	58[2]	60	---	---	32
Fat Clay (CH)	23 to 30	58[2]	---	0.005	2,000	---

1. Grade at the time of our field program.
2. Submerged unit weight.

Design of drilled straight shafts should also include an evaluation of the structural capacity of the foundation element which may limit the allowable capacity.

There are numerous factors which contribute to the behavior of groups subjected to axial load. Several of these factors are foundation type, size and length, spacing, overall group size, loading conditions, installation procedures and soil type and strength. We recommend a minimum spacing of three diameters, center-to-center, for shafts placed in groups beneath square or rectangular caps. However, for shafts placed in a linear pattern beneath load bearing walls, a minimum spacing of two diameters, center-to-center, would generally be acceptable. Closer spacing than three diameters in groups or

two diameters in rows could result in increased group settlement and a reduction of load-carrying capacity of individual foundation elements.

Settlement of a single, isolated shaft will depend on the elastic properties of the foundation, the applied load, and the interaction of the soil and foundation. Settlement is anticipated to be primarily elastic and will occur relatively soon as load is applied. Significant consolidation settlement due to applied load is not anticipated for the allowable capacities. Our experience indicates that a single, isolated foundation loaded to about one-half of its ultimate capacity will result in settlements of about one inch or less. Groups generally undergo more settlement than single, isolated foundation elements for the same applied load. Based on the above recommended spacing, we anticipate that settlement of a group will be on the order of one inch under working loads with differential settlement between foundations to be about one-half inch.

The drilled straight shaft foundations will provide resistance to lateral loads through the passive earth pressure acting on the side of the foundation. A detailed lateral load analysis of the proposed straight shaft footings was beyond the scope of this project. If requested, a detailed lateral load analysis of the proposed drilled straight shaft foundations can be performed by Terracon. Lateral loads should not exceed the structural capacity of the individual drilled straight shaft.

Drilled straight shaft foundations will provide resistance to structural uplift loads through the mobilization of the skin friction acting at the interface of the shaft sidewall and the adjacent soils. The allowable skin friction values provided in the previous table may be used to calculate the uplift resistance for the shafts.

Construction Considerations – Drilled Straight Shafts

The drilling contractor should be experienced in the subsurface conditions observed at the site, and the excavations should be performed with equipment capable of providing a clean bearing area. The drilled straight shaft foundation should be installed in general accordance with the procedures presented in "Drilled Shafts: Construction Procedures and LRFD Design Methods," by Brown, D.A., Turner, J.P., and Castelli, R.J., FHA Publication No. FHWA-NHI-10-016, 2010 and "Standard Specification for the Construction of Drilled Piers", ACI Publication No. 336.1-01, 2001.

The successful completion of the drilled straight shaft will depend to a large extent on the suitability of the equipment and the operator's skills. The operation sequence should be scheduled so that the shaft excavation can be completed, reinforcing steel placed, and the concrete poured in a continuous, rapid, and orderly manner to minimize the time the excavation is open. Concrete should be placed as soon as practical and in all instances should be placed within the same day in order to use the side friction values recommended in this report.

Based on the subsurface conditions observed, the installation of drilled straight shafts will likely require the use of the Slurry Displacement Method and/or temporary steel casing due to the presence of sandier/siltier zones and groundwater. If drilled shaft installation is attempted without utilizing Slurry Displacement Method or temporary casing, zones of sloughing soils and/or groundwater inflow may occur during construction. Therefore, we recommend that provisions be incorporated into the plans and specifications to utilize slurry or casing to control sloughing and/or groundwater seepage during shaft construction.

The need for casing or slurry will depend on the depth of the drilled shaft and the groundwater conditions at the time of construction. If casing is used and seepage persists, the water accumulating in the foundation excavation should be pumped out. The condition of the bearing surface should be evaluated immediately prior to placing concrete, if casing is used in lieu of slurry. If groundwater inflow is too severe to be controlled by the use of casing and pumping or significant sloughing of the sidewalls occurs, the slurry method of construction should be utilized to complete the foundation installation.

Where casing is used, removal of the casing should be performed with extreme care and under proper supervision to minimize mixing of the surrounding soil and water with the fresh concrete. Rapid withdrawal of the casing may develop a suction that could cause the soil and water to flow into the excavation. An insufficient head of concrete in the casing during withdrawal could also allow the water to intrude into the wet concrete. Under no circumstances should loose soil be placed in the annulus between the casing and the drilled shaft sidewalls. The casing must be removed in order to utilize the skin friction values previously provided.

During slurry displacement, the foundation excavation is filled with a slurry mixture. The level of slurry should be maintained above the groundwater level to maintain a positive head in the foundation excavation. Therefore, the slurry tends to seep out of the excavation, rather than the groundwater seeping into the open excavation. The slurry must be maintained in the foundation excavation until design termination depth is achieved and should be removed only as concreting proceeds. The properties of the slurry including the density, viscosity, and pH must be carefully controlled and should be in accordance with Item 416 of Texas Department of Transportation (TXDOT) Standard Specifications for Construction of Highways, Streets, and Bridges.

Slurry left in place for long periods of time will build up on the sides of the shaft causing a reduction in skin friction.

The following procedures and equipment are recommended for installation of drilled shafts by the Slurry Displacement Method:

- The bottom of the drilled straight shaft should be cleaned as well as practical just prior to concreting to remove cuttings.

- The concrete should be placed by means of a tremie with a one-way valve to prevent slurry from entering the pipe. The tremie should extend to the bottom of the drilled shaft to allow displacement of the slurry during concrete placement.
- During concrete placement, the end of the tremie should remain several feet within the concrete mass to reduce the entrapment of slurry. A tremie embedment of 5 to 10 feet is generally considered acceptable.
- The concrete should be relatively fluid to reduce the entrapment of slurry. We recommend that concrete with a slump of 6 to 8 inches be used.
- The upper few feet of concrete should be expunged from the shaft excavation if found to be contaminated with slurry or soil.

A surface casing may be required in addition to the slurry for shaft installation at this site if sloughing of near surface soils occurs. Where casing is used, removal of the casing should be performed with extreme care as previously discussed in this section.

Production shaft installation should be observed by a qualified technician experienced in drilled shaft installation techniques. At a minimum, the technician should observe shaft excavation, note any unusual installation occurrences, observe slurry properties and/or casing installation and removal, observe concrete placement and generally evaluate if shaft installation is being performed in accordance with project specifications.

Foundation Construction Monitoring

The performance of the foundation system for the proposed building will be highly dependent upon the quality of construction. Thus, we recommend that fill pad compaction and foundation installation be observed full time by an experienced Terracon soil technician under the direction of our geotechnical engineer. During foundation installation, the base of the foundation excavations should be observed to evaluate the condition of the subgrade. We would be pleased to develop a plan for compaction and foundation installation observation to be incorporated in the overall quality control program.

Floor Slab

Based on information provided by PBK, the planned finished floor elevation for the proposed building is planned to be +153.00 feet, which is approximately 1 to 2 feet above existing grade. If grading is planned to be altered from what has been previously described, Terracon should be notified to review and/or modify our recommendations given in this subsection.

The near surface soils observed at this site generally exhibit a variable expansion potential. These soils can subject the interior floor slab of the building to significant movements (due to shrinking and swelling) with fluctuations in their moisture content.

This movement potential is influenced primarily by the properties of the subgrade soils, as well as the moisture content of the subgrade at the time of construction, overburden pressures, and the stability of the moisture contents throughout the life of the building. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of up to approximately 2¾ inches. Therefore, we highly recommend that the near-surface soils be prepared as stated below to reduce the potential for slab movement associated with volumetric changes of the near-surface clay soils due to moisture variations to a more acceptable level. The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structure after construction.

Methods exist which reduce the expansive potential of the subgrade such that a grade supported floor slab could be considered. While the grade supported floor slab option is not as effective as a suspended floor slab in reducing slab movements, they do represent a compromise between economics and risk of slab distress. Therefore, we highly recommend that the near-surface soils be prepared as stated below to reduce the potential for slab movement associated with volumetric changes of the near-surface clay soils due to moisture variations to a more acceptable level. The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structure after construction.

The most common method of subgrade preparation to reduce potential expansion of the subgrade for a grade supported floor slab would be to provide a pad of properly placed and compacted select fill beneath the building. The corresponding decrease in the potential soil movements is primarily a function of the fill pad thickness and the moisture levels of the underlying clay subgrade. While the indicated preparations do not eliminate the potential for soil movement, the magnitude of such movements should be reduced to more acceptable levels. To provide uniform support to the floor slab and to reduce the estimated PVR to approximately one inch or less, we recommend that a minimum 48 inches of properly placed and compacted select fill material be constructed immediately beneath the building. The select fill pad should extend a minimum of 5 feet beyond the edge of the building area. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the structure.

The subgrade and select fill beneath the floor slab should be prepared as outlined in the Earthwork section of this report, which contains material and placement requirements for select fill, as well as other subgrade preparation recommendations.

The subgrade soils for flatwork outside of the building which will be sensitive to movement should be prepared as discussed previously. This preparation will be important on surrounding sidewalks and paving immediately adjacent to the building. If these adjacent flatwork areas are not prepared as stated above for the floor slab area,

the estimated PVR for these areas could approach those indicated previously for in-situ conditions. If the soils swell in these areas, this movement could result in significant distress to the adjacent sidewalks and paving and possibly result in reversed drainage (flow of runoff toward the building) around the perimeter of the building.

Utility Construction Considerations

As previously stated, we understand open-cut construction methods are planned for the proposed underground utilities and that the maximum embedment depth is planned to be 15 feet below the existing grade. The utility construction considerations provided below are based on the soil and groundwater conditions observed during our field and laboratory programs.

Excavation Considerations

Based on our understanding of the project, we understand that excavations up to 15 feet below existing grade are planned for this project. The sides of below-grade structure excavations may either be sloped or formed with vertical cuts. For vertical sided excavations greater than 5 feet in depth, the excavations will require the use of shoring, bracing or some form of retention to prevent sloughing and caving of the soil into the excavation.

The contractor should use a trench box or shoring and bracing as necessary to maintain a safe and clean excavation which meets with the Occupational Safety and Health Administration (OSHA) requirements. Excavations must be performed and inspected under the supervision of a contractor designated Competent Person. The Competent Person, as defined by the OSHA Standard, 29 CFR Part 1926.650 to .652, Subpart P – Excavations, must evaluate the excavations at the time of construction activity to safeguard workers.

OSHA standards provide recommendations for the design of temporary sloped excavations with a depth more than 5 feet and less than 20 feet. The OSHA standards provide maximum allowable slopes contingent on three designated soil types: Type A, Type B, and Type C. According to OSHA standards, temporary sloped excavations should be no steeper than 0.75-horizontal on 1-vertical (0.75H:1V) for Type A soils, 1H:1V for Type B soils, and 1.5H:1V for Type C soils. The soils type should be evaluated by a contractor designated Competent Person at the time of construction. The surface soils should be protected from deterioration and weathering if they are left open for significant periods of time.

Excavations should be performed with equipment capable of providing a relatively clean bearing area. Excavating equipment should not disturb the soil beneath the design excavation bottom and should not leave loose soil in the excavation. The bearing surface

should be protected against disturbance and deterioration by completing the utility line installation and backfilling operations as quickly as possible. The excavation bottom should be properly sloped to allow water infiltrating into the excavation to be collected at a convenient location along the edge of the excavation. Water should not be allowed to stand within the bearing area.

As a safety measure, no equipment should be operated within 5 feet of the edge of the excavation and no materials should be stockpiled within 10 feet of the excavation. Excavations should not approach closer than 10 feet from existing structures/facilities without some form of protection for the facilities. Proper berming or ditching should be performed to divert any surface runoff away from the excavation.

Groundwater Control

Based on the soil and groundwater information obtained during our field activities (refer to section Groundwater Conditions), we anticipate that excavations for the proposed below-grade portions and footings that extend into the near-surface clay soils may occur without advance dewatering. Seepage from the clay soils is expected to be minor and can likely be managed by pumping water collected with sumps positioned in the bottom of the excavation. Care should be taken to slope the excavation towards the sumps such that water can be collected and removed from the excavation.

However, excavations that extend through zones of sandy/silty soils such as observed at borings B-13, B-15 through B-17, PB-2, and PB-3 at a depth as shallow as 10 feet below existing grade may require some form of advanced dewatering, such as vacuum wellpoints, depending on the groundwater conditions at the time of construction. Groundwater is typically controlled by the installation of vacuum wellpoints. However, vacuum wellpoints are generally less effective below a depth of about 15 feet beneath the top of the well-point. Deeper dewatering typically requires eductors or deep wells with submersible pumps or multi-stage well-point systems.

The suggested methods given above serve as a guideline for groundwater control; other appropriate means may be required for groundwater control during construction. Control of groundwater should be accomplished in a manner that will preserve the strength of the soils, will not cause instability of the excavation, and will not result in damage to existing structures, if any. If necessary the water should be lowered in advance of excavation by well point, deep wells, eductors, or similar methods. Open pumping should not be permitted if it results in boils, loss of fines, softening of the subgrade, or excavation instability. Wellpoints, deep wells, and eductors should be installed with suitable screen filter so that pumping of fines does not occur.

Dewatering of the loose to medium dense sands might cause subsidence or compression of adjacent soils and adjacent structures, in spite of safeguards and methodology selected and used. Therefore, the dewatering operations must be performed and

provided with great care to ensure caution and control of the potential subsidence resulting from the dewatering operations.

If advance dewatering is performed, the well system should be in operation for at least several days prior to excavating to the design depth. We recommend that the groundwater head be lowered at least 3 feet below the bottom of the excavation to provide a working area with increased stability. In addition, dewatering should continue until the construction has been completed and the dewatering system should be turned off in stages to allow groundwater to recover to its original level gradually, over a periods of about 3 to 5 days.

As stated previously, the groundwater levels will fluctuate with seasonal and climatic changes and should be evaluated just prior to construction. To evaluate the groundwater conditions in the area of the proposed building, piezometers may be installed, or trenches/test pits may be excavated to the planned excavation depth. Based on the observed water levels, the contractor should determine effective methods of groundwater management prior to starting excavation operations.

Lateral Earth Pressures

Backfill around embedded structures will impose active to at-rest earth pressures against the embedded walls. Design lateral earth pressures for backfill are estimated to be equivalent to a fluid pressure of 90 pounds per cubic foot (pcf) for clean sand backfill and 110 pcf for in-situ native clay backfill. These pressures include hydrostatic pressures but do not include surcharge forces imposed by construction or vehicular loading. The lateral pressure produced by surcharge may be computed as 50 percent of the vertical surcharge pressure applied as a constant pressure over the full depth of the buried structure. A 2-foot compacted clay seal should be placed at the top of sand backfill to reduce the amount of infiltration of surface water.

Utility Bedding

The subgrade and bedding for the proposed storm sewer lines should conform to the relevant Fort Bend County Engineering Department “Storm Sewer Construction Details”. In general, the pipe should be installed in continuous envelopes of cement stabilized sand. The soil observed in the boring at the estimated utility bedding depth generally consisted of lean clay or sand/silt soils.

The excavations should be inspected to detect any variation in soil conditions from that found in our field and laboratory programs. Any changes noted in the soil stratigraphy should be brought to the attention of Terracon so they can then be assessed and changes to the required bedding details can be made.

Utility Backfill

The type of fill placed above the utility bedding will depend on whether the surface above the utilities are paved or unpaved ground. If the surface is outside of the pavement areas, then the backfill should consist of the excavated, native soils provided they are free of debris and organics. The in-situ soils used as backfill should be placed in thin lifts not exceeding 8 inches loose measure, moisture conditioned to within 4 percent wet of the optimum moisture content and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.

Within pavement areas or within 3 horizontal feet of pavement, the backfill should consist of cement stabilized sand to within 12 inches of the top of the subgrade compacted to at least 95 percent of the Standard Effort (ASTM D 558) maximum dry density. On-site clean soils compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density should be placed above the cement stabilized sand.

Prior to any filling operations, samples of the proposed borrow materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction are being attained.

Settlement of Trench Backfill

We understand that the maximum embedment depth for the proposed utilities is planned to be up to 15 feet below existing grade. Settlement should be expected in the deeper areas of backfilled soils. The potential for settlement is increased if the backfill is not properly placed and compacted. To reduce the potential of settlement, other alternatives such as backfilling with cement stabilized sand may be considered in lieu of on-site material. Terracon can provide recommendations if these alternatives are being considered.

Seismic Considerations

Description	Value
2021 International Building Code (IBC)[1]	D[2]

1. In general accordance with the *2021 International Building Code,* Table 1613.3.2 and *ASCE 7,* Chapter 20.
2. The 2021 International Building Code (IBC) requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope did

Description	Value
	not include a 100-foot deep soil boring. Borings for the building extended to a maximum depth of approximately 30 feet. Based on the International Building Code (IBC) 2021, "When the soil properties are not known in sufficient detail to determine the Site class, Site Class D shall be used unless the building official or Geotechnical data determines that Site Class E or F is likely to be present at the site." Therefore, based on our knowledge and experience with the local site geology and a review of available field and laboratory data, the seismic site class in accordance with the IBC 2021 should be assumed to be Site Class D.

Pavements

Once the subgrade is properly prepared, both flexible pavement systems (consisting of asphaltic concrete and base material) and rigid pavement systems may be considered for this project. Detailed traffic loads and frequencies were not available. However, we anticipate that traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with garbage trucks and large multi-axle delivery trucks/buses from time-to-time in driveway areas.

Tabulated in the following table are the assumed traffic frequencies and loads used to design pavement sections for this project. When actual traffic conditions have been determined Terracon should be contacted to review the information to consider a need for revision of the pavement designs and related recommendations.

Pavement Area	Traffic Design Index [1]	Description
Automobile Parking Areas	DI-1	Light traffic (Few vehicles heavier than passenger cars, no regular use by heavily loaded two axle trucks/buses.) (EAL [2] < 6)
Driveways (Light Duty)	DI-2	Medium to light traffic (Similar to DI-1 including not over 50 loaded two axle trucks/buses or lightly loaded larger vehicles per day. No regular use by heavily loaded trucks with three or more axles.) (EAL = 6-20)
Driveways and Truck Traffic Areas (Medium Duty)	DI-3	Medium traffic (Including not over 300 heavily loaded two axle trucks/buses plus lightly loaded trucks with three or more axles and no more than 30 heavily loaded trucks with more than three axles per day.) (EAL = 21-75)

Pavement Area	Traffic Design Index [1]	Description

1. Based on NSSGA traffic design indices.
2. Equivalent daily 18-kip single-axle load applications.

The top 6 inches of the finished subgrade soils directly beneath the pavements should be chemically treated with lime or a mixture of lime-flyash. The decision about the type and proper amount of additive should be made after the subgrade is open for inspection. Chemical treatment will increase the supporting value of the subgrade and decrease the effect of moisture on subgrade soils. These 6 inches of treatment is a required part of the pavement design and is not a part of the site and subgrade preparation for wet/soft subgrade conditions.

Listed below are pavement component thicknesses, which may be used as a guide for pavement systems at the site for the traffic classifications stated herein. These systems were derived based on general characterization of the subgrade. Specific testing (such as CBR's, resilient modulus tests, etc.) was not performed for this project to evaluate the support characteristics of the subgrade.

Rigid Pavement System			
Component	Material Thickness, Inches		
	DI-1	DI-2	DI-3
Reinforced concrete	5.0	6.0	7.0
Treated subgrade	6.0	6.0	6.0

Flexible Pavement System		
Component	Material Thickness, Inches	
	DI-1	DI-2
Asphaltic concrete	2.0	2.5
Base material	8.0	10.0
Treated subgrade	6.0	6.0

Waste dumpster areas should be constructed of at least 7 inches of reinforced concrete pavement. The concrete pad areas should be designed so that the vehicle wheels of the

collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading imposed during waste collection.

Presented below are our recommended material requirements for the various pavement sections.

Reinforced Concrete Pavement – The materials and properties of reinforced concrete pavement should meet applicable requirements in the ACI Manual of Concrete Practice. The portland cement concrete mix should have a minimum 28-day compressive strength of 3,500 psi.

If river gravel is planned to be utilized in the portland cement concrete mix, Terracon should be contacted for additional services. The presence of river gravel in the portland cement concrete mix can result in excessive cracking and distress to the concrete pavement as a result of differing thermal expansion properties between the river gravel and cement paste. Special care should be taken in developing the project's portland cement concrete mix design, joint layout, and placement to help reduce the potential for excessive cracking and distress if river gravel is planned to be utilized for the project.

Reinforcing Steel – ACI recommendations indicate that distributed steel reinforcement is not necessary when the pavement is properly jointed to form short panel lengths that will help reduce intermediate cracking. Provided the concrete pavement is designed and constructed as stated herein, the installation of reinforcing steel is optional and should be evaluated by the design team. Proper layout and installation of the joints within the pavement is critical to help control intermediate cracking.

If reinforcing steel is planned to be utilized in the concrete pavement by the design team, the following amount of reinforcing steel should be used as a guideline:

- DI-1: #3 bars spaced at 18 inches or #4 bars spaced at 24 inches on centers in both directions.
- DI-2: #3 bars spaced at 12 inches or #4 bars spaced at 18 inches on centers in both directions.
- DI-3: #4 bars spaced at 18 inches on centers in both directions.

Control Joint Spacing – ACI recommendations indicate that control joints should be spaced at a maximum spacing of 30 times the thickness of the pavement for unreinforced parking lot pavements. Furthermore, ACI recommends a maximum control joint spacing of 12.5 feet for 5-inch pavements and a maximum control joint spacing of 15 feet for 6-inch or thicker pavements. Sawcut control joints should be cut within 4 to 12 hours of concrete placement to help control the formation of plastic shrinkage cracks as the concrete cures. The depth of the joint should be at least one-quarter of the slab depth when using a conventional saw or one inch when using early entry saws. The width of the cut should be in accordance with the joint sealant manufacturer recommendations.

Expansion Joint Spacing – ACI recommendations indicate that regularly spaced expansion joints may be deleted from concrete pavements. Therefore, the installation of expansion joints is optional and should be evaluated by the design team.

Construction Joints – When concrete is planned to be placed at different times, we recommend the use of a construction joint between paving areas. The construction joint should consist of a butt joint (not a keyway joint).

Concrete Curing Compound – A concrete curing compound, such as a Type 2 membrane curing compound conforming to TxDOT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or equivalent, should be applied to the concrete surface immediately after placement of the concrete in accordance with TxDOT 2014 Standard Specifications Item 360.

Dowels at Expansion/Construction Joints – The smooth dowels at expansion/construction joints should be spaced at 12-inch centers and consist of the following:

- DI-1: 5/8-inch diameter, 12-inches long with 5-inch embedment.
- DI-2: 3/4-inch diameter, 14-inches long with 6-inch embedment.
- DI-3: 7/8-inch diameter, 14-inches long with 6-inch embedment.

One end of the dowels should either be greased or sleeved to allow for lateral movement to occur.

Hot Mix Asphaltic Concrete Surface Course – The asphaltic concrete surface course should be plant mixed, hot laid Type D (Fine Graded Surface Course) meeting the requirements in TxDOT 2014 Standard Specifications Item 340. Specific criteria for the job specifications should include compaction to within an air void range of 3.8 to 8.5 percent calculated using the maximum theoretical specific gravity of the mix measured by TxDOT Tex-227-F. The asphalt cement content by percent of total mixture weight should be within ± 0.5 percent asphalt cement from the job mix design.

Base Material – Base material should be composed of crushed limestone or crushed concrete meeting the requirements of TxDOT 2014 Standard Specifications Item 247, Type A or D, Grade 1 or 2. The base material should be compacted to at least 95 percent of the Modified Effort (ASTM D1557) maximum dry density at moisture content within 2 percent of the optimum moisture content.

Lime-Flyash Treated Subgrade – The low to medium plasticity clay soils (PI<15) and sand/silt soils should be treated with lime-flyash in accordance with TxDOT 2014 Standard Specifications Item 265. Based on the classification test results, we recommend about 2 to 3 percent lime and 7 to 8 percent flyash by dry weight be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 10 to 15 pounds of lime and 35 to 40 pounds of flyash per square yard per 6-inch depth. Lime-flyash is also available pre-mixed, typically in

percentages of 20 to 30 percent lime and 70 to 80 percent flyash. These pre-mixed products may be used if preferred at a rate of 50 pounds per square yard per 6-inch depth. The actual quantity of lime-flyash should be determined at the time of construction based on laboratory testing conducted using bulk samples of the subgrade soils. The subgrade should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 2 percent of the optimum moisture content.

Lime Treated Subgrade – The medium to high plasticity clay soils (PI≥15) should be treated with lime in accordance with the TXDOT 2014 Standard Specifications Item 260. The amount of lime should be determined for subgrade soils by conducting laboratory tests just prior to construction. Based on the classification test results, we recommend that about 7 to 9 percent lime by dry weight be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 35 to 45 pounds of lime per square yard per 6-inch depth. The actual quantity of lime should be determined at the time of construction based on lime determination tests conducted using bulk samples of the subgrade soils. The pulverization, mixing and curing of the lime treated subgrade is of particular importance in these clays. The subgrade should be compacted to a minimum of 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content between optimum and 4 percent wet of the optimum moisture content.

Preferably, traffic should be kept off the treated subgrade for 7 days to facilitate curing of the soil-chemical mixture. In addition, the subgrade is not suitable for heavy construction traffic prior to paving.

The pavement design methods described above are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade such as the soils encountered at this site. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. Post-construction subgrade movements and some cracking of pavements are not uncommon for clay subgrade conditions such as those observed at this site. Reducing moisture changes in the subgrade is important to reduce shrink/swell movements. Although chemical treatment will help to reduce such movement/cracking, this movement/cracking cannot be feasibly eliminated.

Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventative maintenance. The following recommendations should be implemented to help promote long-term pavement performance:

- The subgrade and the pavement surface should be designed to promote proper surface drainage, preferably at a minimum grade of 2 percent;
- Install joint sealant and seal cracks immediately;
- Extend curbs into the treated subgrade for a depth of at least 4 inches to help reduce moisture migration into the subgrade soils beneath the pavement section; and
- Place compacted, low permeability clayey backfill against the exterior side of the curb and gutter.

Preventative maintenance should be planned and provided for the pavements at this site. Preventative maintenance activities are intended to slow the rate of pavement deterioration, and consist of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Prior to implementing any maintenance, additional engineering observations are recommended to determine the type and extent of preventative maintenance.

General Comments

Our work is conducted with the understanding of the project as described in the proposal and incorporates collaboration with the design team as we completed our services to verify assumptions. Revision of our understanding to reflect actual conditions important to our work was based on these verifications and it is reflected in this report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

Our analysis and opinions are based upon our understanding of the geotechnical conditions in the area, the data obtained from our site exploration and from our understanding of the project. Variations will occur between exploration point locations, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in the final report, to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing

services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other services should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is solely for information purposes only. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing.

Figures

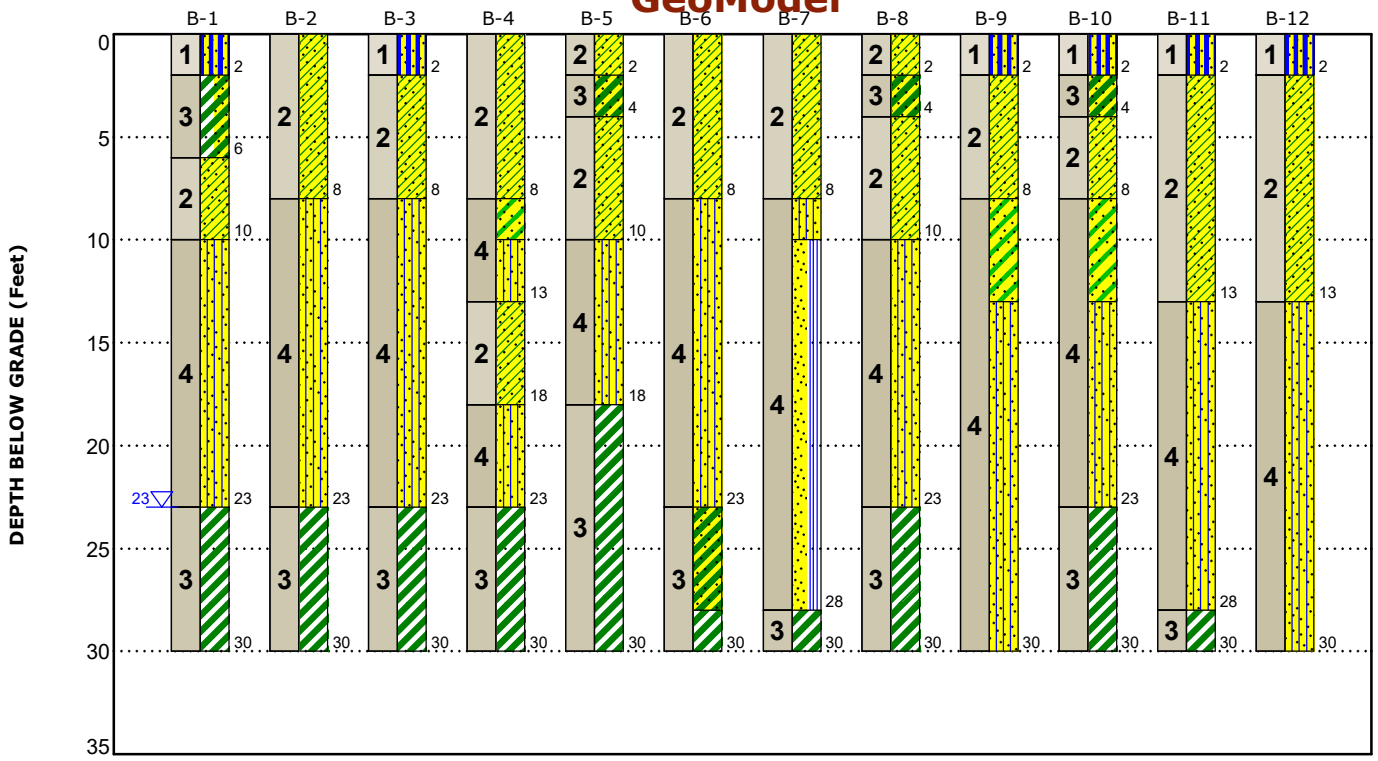
Contents:

GeoModel

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Sandy Silt	dark gray, very loose to medium dense, with scattered roots and clay pockets
2	Sandy Lean Clay	dark gray, light gray, and reddish brown, very soft to hard, with silt and sand pockets, and ferrous stains
3	Fat Clay and Sandy Fat Clay	light gray and reddish brown, stiff to hard, with sand pockets, ferrous stains, and calcareous nodules
4	Clayey Sand, Poorly Graded Sand with Silt, and Silty Sand	light gray and reddish brown, loose to dense, with clay pockets

Legend

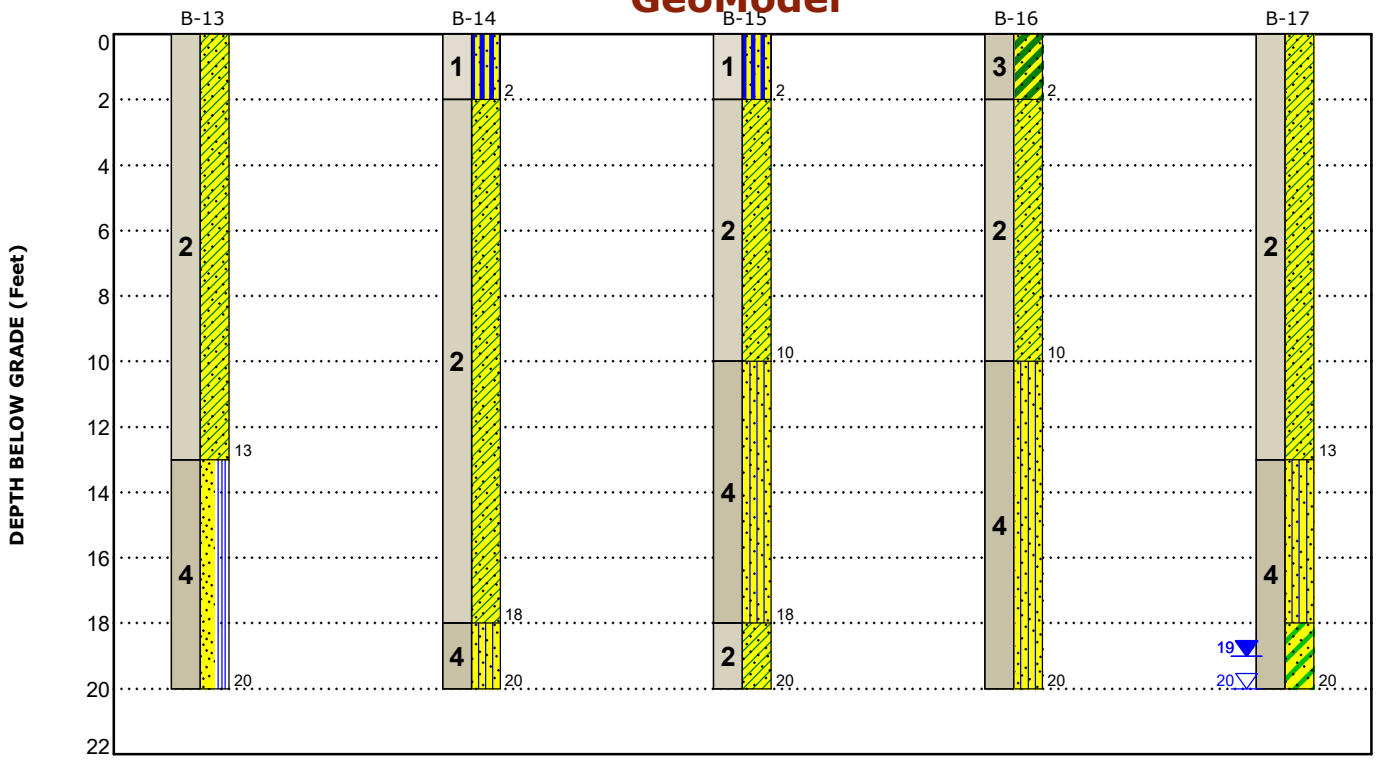
- Sandy Silt
- Sandy Lean Clay
- Fat Clay
- Sandy Fat Clay
- Fat Clay with Sand
- Silty Sand
- Clayey Sand
- Poorly-graded Sand with Silt

▽ First Water Observation
▽ Second Water Observation
▼ Third Water Observation
Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Terracon
11555 Clay Rd, Ste 100
Houston, TX

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Legend

- Sandy Lean Clay
- Poorly-graded Sand with Silt
- Sandy Silt
- Silty Sand
- Sandy Fat Clay
- Clayey Sand

First Water Observation
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Third Water Observation

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Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet) [1]	Location
12 (B-1 through B-12)	30	Proposed school building area
5 (B-13 through B-17)	20	Proposed pavement and utility areas
2 (PB-2 and PB-3)	30	

1. Below existing grade at the time of our field program.
2. Boring drilled for Terracon Project No. 92235414, October 4, 2023.

Boring Layout and Elevations: We used handheld Global Positioning System (GPS) equipment to locate the approximate latitude and longitude of the borings with an accuracy of +/-25 feet. The boring depths were measured from the existing ground surface at the time of our field activities.

Subsurface Exploration Procedures: We advanced soil borings with an all-terrain vehicle (ATV) mounted drill rig using solid stem continuous flight augers. Samples were obtained at 2-foot intervals in the upper 12 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was typically performed using open-tube and/or split-barrel sampling procedures.

Cohesive soil samples were generally recovered using open-tube samplers. Hand penetrometer tests were performed on samples of cohesive soils in the field to serve as a general measure of consistency.

Granular soils and soils for which good quality open-tube samples could not be recovered were sampled by means of the Standard Penetration Test (SPT). This test consists of measuring the number of blows (N) required for a 140-pound hammer free falling 30 inches to drive a standard split-spoon sampler 12 inches into the subsurface material after being seated six inches. This blow count or SPT “N” value is used to evaluate the stratum. An automatic SPT hammer was used in advancing the split-spoon sampler at the borings. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT N-values and soil properties are based on the lower efficiency cathead and rope method. The higher efficiency of an automatic SPT hammer affects the SPT N-value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method.

The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer. In addition, we observed and recorded groundwater levels during drilling and sampling.

Our exploration team prepared field boring logs as part of standard drilling operations including sampling depths, penetration distances, and other relevant sampling information. Field logs include visual classifications of materials observed during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent an interpretation of the field logs by a geotechnical engineer and include modifications based on laboratory observation and tests on select samples.

Property Disturbance: We backfilled the borings with auger cuttings upon completion. Excess auger cuttings were dispersed in the general vicinity of the boring. Our services do not include repair of the site beyond backfilling our borings. Because backfill material often settles below the surface after a period, we recommend borings be periodically checked and backfilled, if necessary. We can provide this service for additional fees, at your request.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D7263 Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D1140 Standard Test Method for Determining the Amount of Materials Finer than No. 200 Sieve in Soils by Washing
- ASTM D2166/D2166M Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

The laboratory testing program included observation of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System (USCS).

Samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period, unless we are notified otherwise.

Site Location and Exploration Plans

Contents:

Site Location
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

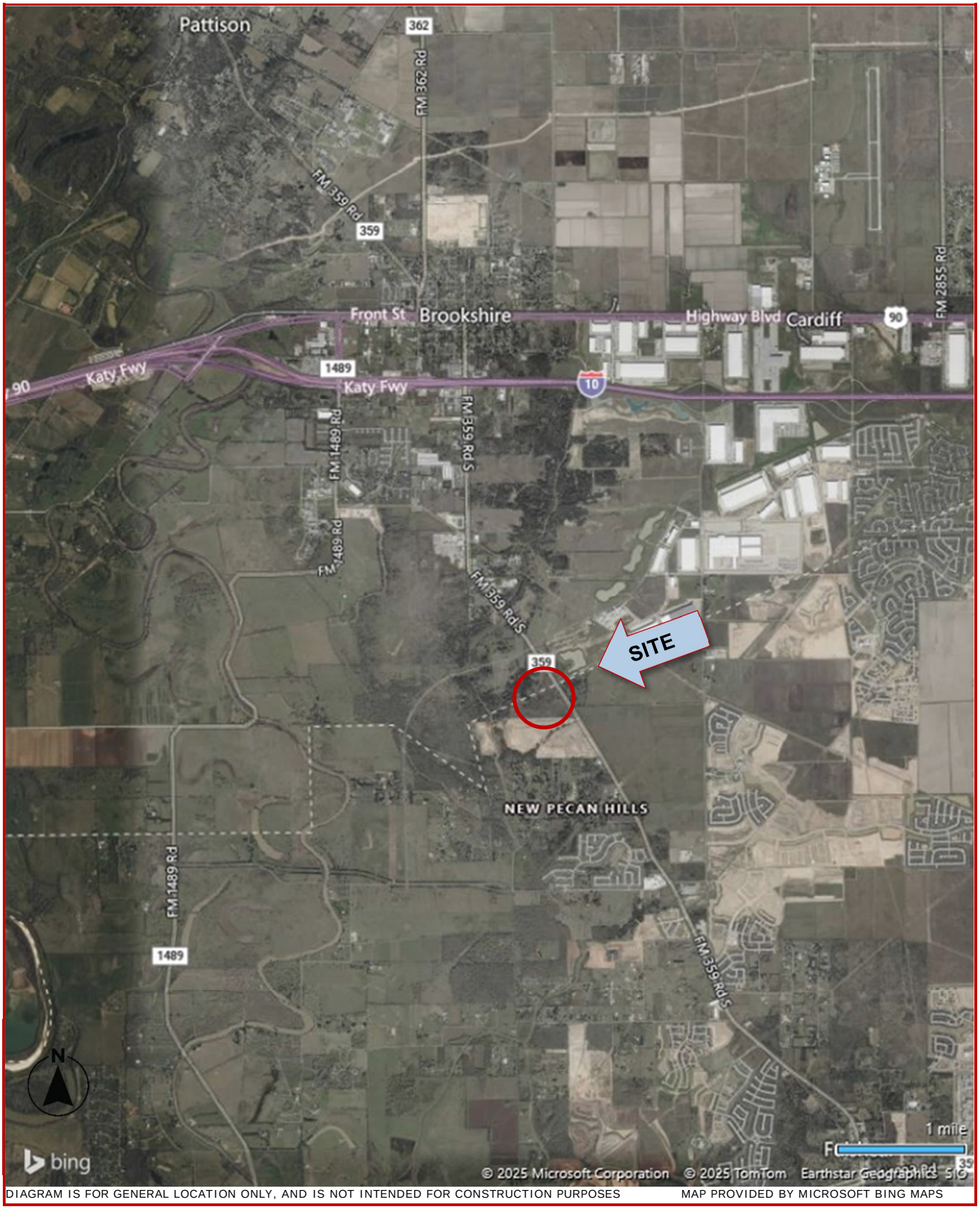


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

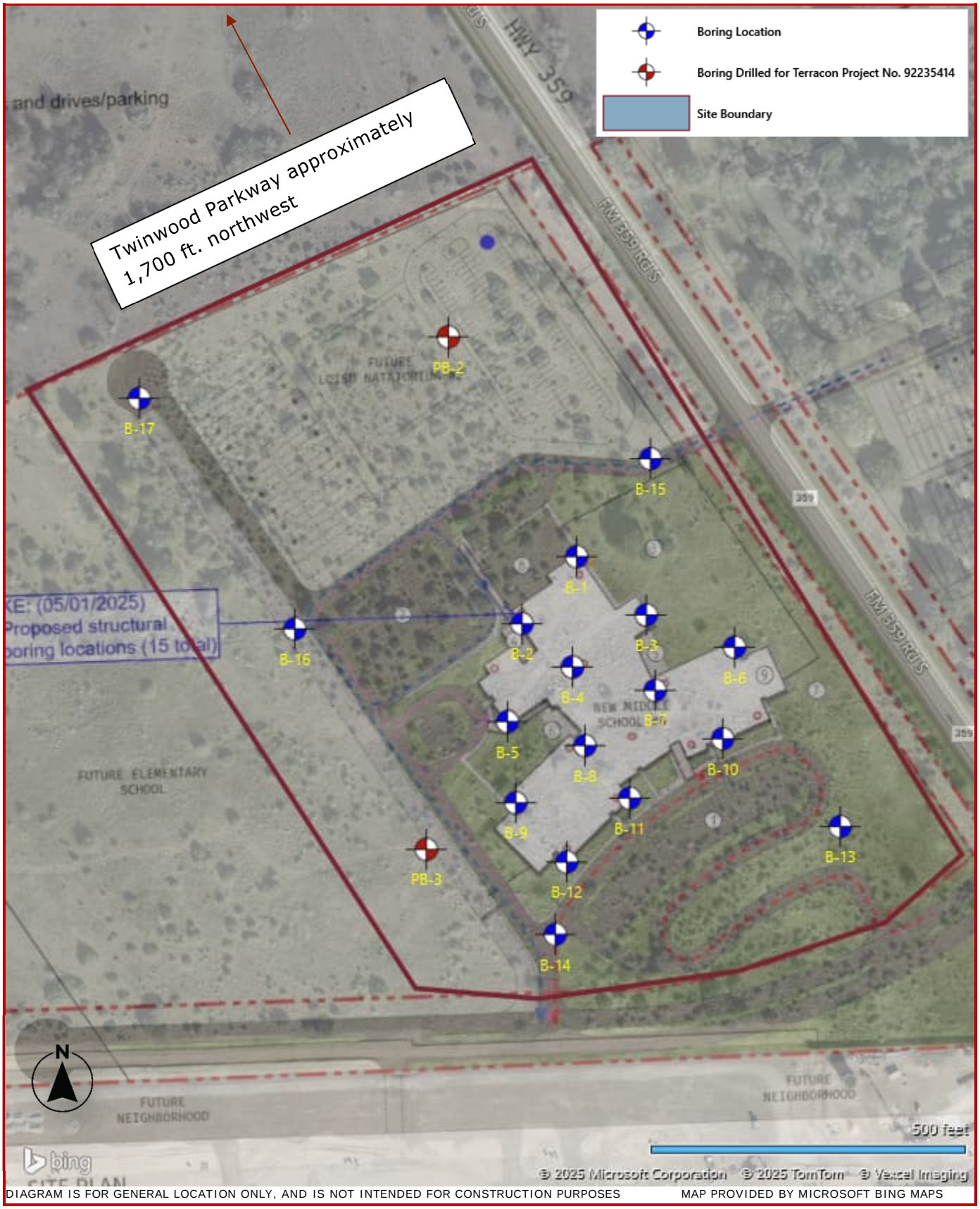


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-17, PB-2, and PB-3)

Note: All attachments are one page unless noted above.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 29.7435° Longitude: -95.9395°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		2.0	**SANDY SILT (ML)**, dark gray, very loose, with scattered roots				WOH							
3		6.0	**FAT CLAY WITH SAND (CH)**, light gray and reddish brown, stiff to very stiff, with sand pockets				2-4-5 N=9				15.4		78-22-56	
				5			3-6-11 N=17							
2		10.0	**SANDY LEAN CLAY (CL)**, light gray and reddish brown, very stiff, with ferrous stains				6-8-11 N=19				11.3		32-14-18	
							8-11-13 N=24							
4		23.0	**SILTY SAND (SM)**, reddish brown, medium dense, with clay pockets	10			7-11-11 N=22				13.3			20
							4-9-10 N=19							
				15	Caved-in at 17 feet									
							9-12-12 N=24							
				20	▽									
3		30.0	**FAT CLAY (CH)**, reddish brown, very stiff, with ferrous stains, calcareous nodules, and sand pockets				6-7-9 N=16				39.7			98
				25			4.0 (HP)							
			Boring Terminated at 30 Feet	30										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ While drilling
Caved-in at 17 feet

Drill Rig
Track

Hammer Type
Automatic

Driller
Terracon

Logged by
D. Page

Boring Started
07-03-2025

Boring Completed
07-03-2025

Notes
WOH = Weigh of Hammer

Advancement Method
Dry augered to 23 feet; wet rotary thereafter.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-2

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.7432° Longitude: -95.9397° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2		**SANDY LEAN CLAY (CL)**, dark gray, very soft to very stiff, with sand pockets				WOH				20.3		32-15-17	
		- light gray and reddish brown, with ferrous stains 2 to 8 feet				3.0 (HP)							
			5			4.5 (HP)				12.0		28-14-14	
						4.5 (HP)							
		8.0											
4		**SILTY SAND (SM)**, reddish brown, medium dense - with clay pockets 8 to 13 feet				8-12-14 N=26				6.7			21
			10			6-10-12 N=22							
						8-11-13 N=24							
			15										
						4-5-6 N=11				7.1			17
			20										
		23.0											
3		**FAT CLAY (CH)**, reddish brown, very stiff				3.5 (HP)							
			25										
						4.5 (HP)							
		30.0											
		Boring Terminated at 30 Feet	30										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Track

Hammer Type
Automatic

Driller
Terracon

Notes
WOH = Weight of Hammer

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
D. Page

Boring Started
07-03-2025

Boring Completed
07-03-2025

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 29.7432° Longitude: -95.9391°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		2.0	**SANDY SILT (ML)**, dark gray, very loose				WOH							
2		8.0	**SANDY LEAN CLAY (CL)**, light gray and reddish brown, stiff to hard, with ferrous stains and sand pockets				2-4-6 N=10				24.0		48-16-32	
				5			4.0 (HP)	UC	7.84	9.3	12.8	122		53
							4.5 (HP)				13.7		38-15-23	
4		23.0	**SILTY SAND (SM)**, light gray, loose to medium dense - reddish brown, with clay pockets 13 to 23 feet	10			4-4-5 N=9							
							4-6-8 N=14							
				15			7-9-9 N=18							
				20			8-12-12 N=24							
3		30.0	**FAT CLAY (CH)**, reddish brown, stiff to very stiff, with ferrous stains and slickensides	25			4.0 (HP)	UC	1.39	1.5	34.7	89		99
							4.5 (HP)							
			Boring Terminated at 30 Feet	30										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Track

Hammer Type
Automatic

Driller
Terracon

Logged by
D. Page

Boring Started
07-03-2025

Boring Completed
07-03-2025

Notes
WOH = Weight of Hammer

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 29.7430° Longitude: -95.9395°

Model Layer	Graphic Log	Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2			**SANDY LEAN CLAY (CL)**, light gray and reddish brown, soft to hard, with sand pockets			WOH				17.2		46-20-26	
						2-3-8 N=11							
		5				4.5 (HP)				10.2		39-14-25	
						10-22-25 N=47							
4			**CLAYEY SAND (SC)**, light gray, medium dense			4-5-6 N=11				9.5			24
		10	10.0 **SILTY SAND (SM)**, light gray, loose			3-4-4 N=8							
2			13.0 **SANDY LEAN CLAY (CL)**, liht gray and reddish brown, very stiff			5-9-10 N=19							
		15											
4			18.0 **SILTY SAND (SM)**, reddish brown, medium dense, with clay pockets			5-5-11 N=16							
		20											
3			23.0 **FAT CLAY (CH)**, reddish brown, very stiff - with sand pockets 23 to 28 feet			3.0 (HP)	UC	2.30	3.9	12.0	111		
		25											
						3.5 (HP)							
		30	30.0 ***Boring Terminated at 30 Feet***										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
J. Grimes

Boring Started
07-01-2025

Boring Completed
07-01-2025

Notes
WOH = Weight of Hammer

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-5

Location: See Exploration Plan

Latitude: 29.7428° Longitude: -95.9398°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2		2.0	**SANDY LEAN CLAY (CL)**, dark gray, medium stiff, with silt pockets				1-3-5 N=8							
3		4.0	**SANDY FAT CLAY (CH)**, dark gray, very stiff, with sand pockets				4.5 (HP)				17.3		69-20-49	
2		10.0	**SANDY LEAN CLAY (CL)**, light gray and reddish brown, very stiff to hard	5			4.5 (HP)	UC	5.01	6.5	11.3	148		
							4.5 (HP)				11.0		37-14-23	
							10-15-22 N=37							
4		18.0	**SILTY SAND (SM)**, reddish brown, dense, with clay pockets	10			13-20-19 N=39							
				15			13-17-18 N=35							
3		30.0	**FAT CLAY (CH)**, reddish brown, very stiff, with ferrous stains - with sand pockets 18 to 28 feet	20			3.5 (HP)	UC	2.96	4.4	20.1	103		
				25			8-9-11 N=20							
				30			4.5 (HP)							
			Boring Terminated at 30 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
J. Grimes

Boring Started
07-01-2025

Boring Completed
07-01-2025

Notes

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

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Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-6

Location: See Exploration Plan

Latitude: 29.7431° Longitude: -95.9387°

Model Layer	Depth (Ft.)	Material Description	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2	0.0	**SANDY LEAN CLAY (CL)**, dark gray, very soft to very stiff, with sand pockets										
					WOH				13.3		22-14-8	
		- light gray and reddish brown, with ferrous stains 2 to 8 feet			2-3-4 N=7							
	5				2.5 (HP)				14.0		41-15-26	
					4.5 (HP)							
	8.0											
4		**SILTY SAND (SM)**, light gray, medium dense, with clay pockets			6-9-10 N=19				9.1			23
	10	- reddish brown 10 to 23 feet			4-7-8 N=15							
					8-11-18 N=29							
	15											
					10-11-8 N=19							
	20											
	23.0											
3		**SANDY FAT CLAY (CH)**, reddish brown, very stiff			7-18-10 N=28							
	25											
	28.0											
		FAT CLAY (CH), reddish brown, very stiff, with ferrous stains			4.0 (HP)							
	30.0											
	30	***Boring Terminated at 30 Feet***										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Track

Hammer Type
Automatic

Driller
Terracon

Notes
WOH = Weight of Hammer

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
D. Page

Boring Started
07-07-2025

Boring Completed
07-07-2025

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-7

Location: See Exploration Plan
Latitude: 29.7429° Longitude: -95.9391°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2			**SANDY LEAN CLAY (CL)**, dark gray, medium stiff to hard, with sand pockets				3-3-2 N=5							
			- light gray and reddish brown 2 to 8 feet				3-8-11 N=19				10.4		40-14-26	
				5			4.5 (HP)	UC	8.36	3.3	9.6	126		51
		8.0					4.5 (HP)				12.1		29-14-15	
4			**SILTY SAND (SM)**, light gray and reddish brown, loose, with clay pockets				4-3-3 N=6							
		10.0		10			5-6-7 N=13				5.1			10
			POORLY GRADED SAND WITH SILT (SP-SM), reddish brown, medium dense to dense				3-5-7 N=12							
				15										
							3-5-7 N=12							
				20										
							9-12-20 N=32							
				25										
		28.0												
3			**FAT CLAY (CH)**, reddish brown, very stiff, with ferrous stains				4.5 (HP)	UC	1.63	1.2	29.2	94		
		30.0		30										
			Boring Terminated at 30 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Track

Hammer Type
Automatic

Driller
Terracon

Logged by
D. Page

Boring Started
07-07-2025

Boring Completed
07-07-2025

Notes

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-8

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.7427° Longitude: -95.9394° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2		**SANDY LEAN CLAY (CL)**, dark gray, very soft				0-1-2 N=3							
		2.0											
3		**SANDY FAT CLAY (CH)**, light gray and reddish brown, very stiff, with ferrous stains				4.5 (HP)				17.1		59-18-41	
		4.0											
2		**SANDY LEAN CLAY (CL)**, light gray and reddish brown, very stiff to hard, with ferrous stains	5			4.5 (HP)	UC	12.96	11.4	11.8	156		
						4.5 (HP)				13.6		42-15-27	
						6-10-13 N=23							
			10			7-6-7 N=13							
4		**SILTY SAND (SM)**, reddish brown, medium dense to dense, with clay pockets				7-12-10 N=22							
			15										
						10-15-15 N=30							
			20										
		23.0											
3		**FAT CLAY (CH)**, reddish brown, very stiff, with ferrous stains				12-13-12 N=25				22.6			91
			25										
						4.5 (HP)							
		30.0	30										
		Boring Terminated at 30 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
J. Grimes

Boring Started
07-01-2025

Boring Completed
07-01-2025

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-9

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.7424° Longitude: -95.9398° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**SANDY SILT (ML)**, dark gray, very loose, with clay pockets				0-1-2 N=3							
		2.0											
		SANDY LEAN CLAY (CL), light gray and reddish brown, medium stiff to hard				2-3-4 N=7							
2			5			4.5 (HP)				11.6		40-14-26	
						4.5 (HP)	UC	5.47	10.1	9.3	120		
		8.0											
		CLAYEY SAND (SC), light gray and reddish brown, medium dense				5-12-10 N=22							
			10			7-7-9 N=16							
		13.0											
4		**SILTY SAND (SM)**, reddish brown, medium dense, with clay pockets				4-6-9 N=15							
			15										
						5-9-15 N=24							
			20										
						6-6-8 N=14							
			25										
						6-10-8 N=18							
		30.0	30										
		Boring Terminated at 30 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
J. Grimes

Boring Started
07-01-2025

Boring Completed
07-01-2025

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-10

Location: See Exploration Plan

Latitude: 29.7427° Longitude: -95.9387°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		2.0	**SANDY SILT (ML)**, dark gray, medium dense, with clay pockets				1.5 (HP)							
3		4.0	**SANDY FAT CLAY (CH)**, dark gray, very stiff, with ferrous stains				3.0 (HP)				19.6		61-18-43	
2		8.0	**SANDY LEAN CLAY (CL)**, light gray and reddish brown, very stiff to hard, with ferrous stains	5			4.5 (HP)	UC	5.66	7	14.6	119		
							4.5 (HP)				15.0		34-15-19	
4		13.0	**CLAYEY SAND (SC)**, reddish brown, medium dense				4.5 (HP)							
				10			7-9-8 N=17							
		23.0	**SILTY SAND (SM)**, reddish brown, medium dense, with clay pockets	15			6-10-11 N=21							
				20			6-8-10 N=18							
3		30.0	**FAT CLAY (CH)**, reddish brown, very stiff to hard, with ferrous stains and sand pockets	25			8-14-18 N=32							
							3.5 (HP)							
			Boring Terminated at 30 Feet	30										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
G. Yeager

Boring Started
06-30-2025

Boring Completed
06-30-2025

Notes

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
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Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-11

Location: See Exploration Plan

Latitude: 29.7424° Longitude: -95.9392°

Model Layer	Graphic Log	Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		2.0	**SANDY SILT (ML)**, dark gray, very loose, with clay pockets				0-0-1 N=1							
2		13.0	**SANDY LEAN CLAY (CL)**, light gray and reddish brown, stiff to very stiff, with sand pockets				2-5-9 N=14							
				5			8-10-12 N=22				10.7		47-15-32	
							8-14-13 N=27							
				10			4-11-11 N=22							
							5-8-13 N=21							
4		28.0	**SILTY SAND (SM)**, reddish brown, medium dense to dense - with clay pockets 13 to 18 feet				8-10-11 N=21							
				15										
				20			8-11-12 N=23							
				25			11-17-23 N=40							
3		30.0	**FAT CLAY (CH)**, reddish brown, very stiff, with ferrous stains				4.0 (HP)							
			Boring Terminated at 30 Feet	30										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
G. Yeager

Boring Started
06-30-2025

Boring Completed
06-30-2025

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-12

Location: See Exploration Plan

Latitude: 29.7422° Longitude: -95.9395°

Model Layer	Depth (Ft.)	Graphic Log	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1	0											
		SANDY SILT (ML), dark gray, loose, with clay pockets			1-2-3 N=5							
	2.0				3-4-5 N=9				20.9		47-15-32	
2	5	**SANDY LEAN CLAY (CL)**, light gray and reddish brown, stiff to hard, with sand pockets			4.5 (HP)	UC	8.65	13.3	12.4	123		55
					4.5 (HP)				13.3		43-15-28	
					4.5 (HP)	UC	3.57	2.3	10.4	114		
	10				4.5 (HP)							
	13.0											
4		**SILTY SAND (SM)**, reddish brown, medium dense to dense, with clay pockets			5-5-7 N=12							
	15											
	20				7-7-8 N=15							
	25				6-20-18 N=38							
	30				10-12-15 N=27							
	30.0											
		Boring Terminated at 30 Feet										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
J. Grimes

Boring Started
07-01-2025

Boring Completed
07-01-2025

Notes

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-13

Location: See Exploration Plan

Latitude: 29.7423° Longitude: -95.9381°

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2		0										
					2-4-4 N=8				12.5		42-17-25	
					3.0 (HP)							
		5			4.5 (HP)	UC	5.79	9.9	14.1	120		
					4.5 (HP)							
					3.0 (HP)							
		10			4-6-6 N=12							
4		13.0										
					3-4-5 N=9				4.6			10
		15										
		20			4-6-8 N=14							

SANDY LEAN CLAY (CL), dark gray, medium stiff to hard, with sand pockets

- light gray and reddish brown 2 to 13 feet

POORLY GRADED SAND WITH SILT (SP-SM), reddish brown, loose to medium dense

Boring Terminated at 20 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
J. Grimes

Boring Started
07-08-2025

Boring Completed
07-08-2025

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-14

Location: See Exploration Plan
Latitude: 29.7419° Longitude: -95.9396°

Model Layer	Graphic Log	Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0	**SANDY SILT (ML)**, dark gray, loose				1-2-3 N=5				13.3		NP	
		2.0												
2			**SANDY LEAN CLAY (CL)**, dark gray, very soft to very stiff, with sand pockets				2-1-1 N=2							
			- light gray and reddish brown 4 to 18 feet	5			4.5 (HP)							
			- with calcareous nodules 6 to 8 feet				9-13-14 N=27							
							4.5 (HP)	UC	2.78	4.2	13.3	112		
				10			8-10-12 N=22							
							5-7-10 N=17							
				15										
		18.0												
4			**SILTY SAND (SM)**, reddish brown, medium dense				6-7-7 N=14							
		20.0		20										
			Boring Terminated at 20 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
J. Grimes

Boring Started
07-08-2025

Boring Completed
07-08-2025

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-15

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.7439° Longitude: -95.9391° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**SANDY SILT (ML)**, dark gray, loose, with clay pockets 2.0				3-4-4 N=8				9.9		16-13-3	
2		**SANDY LEAN CLAY (CL)**, dark gray, very stiff, with sand pockets - light gray and reddish brown 4 to 10 feet 10.0	5			3-5-11 N=16							
						8-12-16 N=28							
						4.5 (HP)	UC	3.25	1.9	10.6	115		
4		**SILTY SAND (SM)**, reddish brown, medium dense 18.0	10			10-14-14 N=28							
						6-9-12 N=21							
			15			8-11-16 N=27							
2		**SANDY LEAN CLAY (CL)**, reddish brown, very stiff, with sand pockets 20.0				3.5 (HP)							
		Boring Terminated at 20 Feet	20										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Track

Hammer Type
Automatic

Driller
Terracon

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

Logged by
D. Page

Boring Started
07-07-2025

Boring Completed
07-07-2025

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-16

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.7432° Longitude: -95.9409° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		**SANDY FAT CLAY (CH)**, dark gray, medium stiff				1-3-4 N=7				16.3		69-22-47	
		2.0											
2		**SANDY LEAN CLAY (CL)**, light gray and reddish brown, stiff to very stiff, with ferrous stains				3.0 (HP)							
			5			3.0 (HP)	UC	1.83	9.1	17.6	110		
						4.5 (HP)							
		10.0											
4		**SILTY SAND (SM)**, reddish brown, medium dense to dense	10			5-10-14 N=24							
						6-7-9 N=16							
		- with clay pockets below 13 feet											
			15			7-15-15 N=30							
		20.0				13-21-23 N=44							
		Boring Terminated at 20 Feet	20										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
J. Grimes

Boring Started
07-08-2025

Boring Completed
07-08-2025

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD Middle School No. 8
Farm to Market Road 359 and Twinwood Parkway | Brookshire, Texas
Terracon Project No. 92255217

11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-17

Location: See Exploration Plan

Latitude: 29.7442° Longitude: -95.9416°

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2		0										
					2-2-3 N=5				16.5		43-16-27	
					2-5-6 N=11							
		5			4.5 (HP)							
					4.5 (HP)	UC	2.36	3.5	10.6	108		
					6-7-10 N=17							
		10			3-4-5 N=9							
					9-12-13 N=25							
4		15										
			▽		4-6-9 N=15							
		20	▽									

SANDY LEAN CLAY (CL), dark gray, medium stiff to very stiff, with sand pockets

- light gray and reddish brown 2 to 13 feet

13.0

SILTY SAND (SM), reddish brown, medium dense, with clay pockets

18.0

CLAYEY SAND (SC), reddish brown, medium dense

20.0

Boring Terminated at 20 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ While drilling
▽ After 5 minutes
▼ After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
J. Grimes

Boring Started
07-08-2025

Boring Completed
07-08-2025

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with soil cuttings upon completion.

LCISD High School No. 8
FM 359 Road and Discovery Hills Parkway | Brookshire, Texas
Terracon Project No. 92235414

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. PB-2

Location: See Exploration Plan

Latitude: 29.7435° Longitude: -95.9362°

Model Layer	Depth (Ft.)	Graphic Log	Material Description	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1	0		**SANDY SILT (ML)**, gray, medium dense, with scattered roots			4.0 (HP)				2.1		15-13-2	
	2.0												
2			**SANDY FAT CLAY (CH)**, light gray and reddish brown, very stiff, with sand pockets, silt seams, and ferrous stains			4.5 (HP)				11.7		57-15-42	
	5					4.5 (HP)							
	6.0												
3			**SANDY LEAN CLAY (CL)**, gray and reddish brown, very stiff to hard, with silt pockets, and ferrous stains and nodules			4.5 (HP)							
	10					4.5 (HP)	UC	6.89	3.5	13.4	116		
	10.0												
4			**CLAYEY SAND (SC)**, reddish brown, dense, with ferrous stains and nodules			4.5 (HP)							
						10-16-19 N=35							
	15												
	18.0												
			SILTY SAND (SM), reddish brown, dense to very dense, with clay pockets			9-13-17 N=30							
	20												
						20-30-45 N=75							
	25												
						21-31-50 N=81							
	30												
			Boring Terminated at 30 Feet										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Caved-in

Drill Rig
ATV

Hammer Type
Rope and Cathead

Driller
DAS

Notes

Advancement Method
Dry augered to 23 feet; wet rotary thereafter.

Abandonment Method
Boring backfilled with auger cuttings and capped with concrete cylinder upon completion.

Logged by
H. Zamudio

Boring Started
09-06-2023

Boring Completed
09-06-2023

LCISD High School No. 8
FM 359 Road and Discovery Hills Parkway | Brookshire, Texas
Terracon Project No. 92235414

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. PB-3

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.7437° Longitude: -95.9331° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**SANDY SILT (ML)**, gray, medium dense, with scattered roots				4.5 (HP)				3.7		15-14-1	
		2.0											
3		**SANDY LEAN CLAY (CL)**, gray, stiff to very stiff, with sand seams				4.5 (HP)							
			5			4.5 (HP)				13.5		40-14-26	
		- reddish brown 6 to 10 feet				4.5 (HP)							
		- with ferrous stains 8 to 10 feet				4.5 (HP)	UC	1.42	2.8	12.6	119		
		10.0	10										
4		**CLAYEY SAND (SC)**, reddish brown, medium dense, with ferrous stains				4.5 (HP)				10.3			30
						9-12-12 N=24							
		18.0	15										
		SILTY SAND (SM), reddish brown, dense to very dense, with clay pockets				10-16-24 N=40							
			20										
						9-17-22 N=39							
			25										
		30.0				10-30-50/5" N=80/11"							
		Boring Terminated at 30 Feet	30										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Caved-in

Drill Rig
ATV

Hammer Type
Rope and Cathead

Driller
DAS

Notes

Advancement Method
Dry augered to 23 feet; wet rotary thereafter.

Abandonment Method
Boring backfilled with auger cuttings and capped with concrete cylinder upon completion.

Logged by
H. Zamudio

Boring Started
09-07-2023

Boring Completed
09-07-2023

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

Terracon
11555 Clay Rd, Ste 100
Houston, TX

General Notes

Sampling	Water Level	Field Tests
Shelby Tube Standard Penetration Test	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

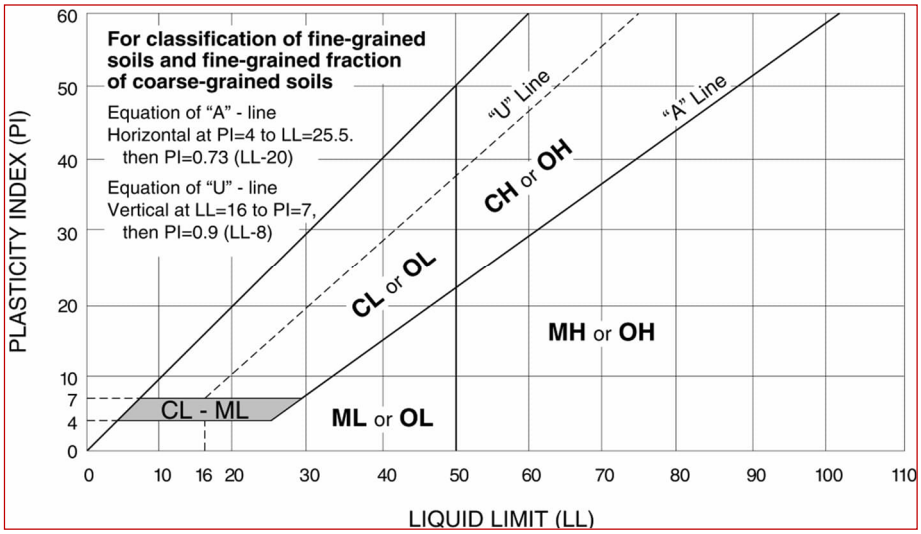
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried}$ < 0.75	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried}$ < 0.75	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



DOCUMENT 00 40 00 - COMPETITIVE SEALED PROPOSAL FORM

MIDDLE SCHOOL 8
LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

Submitted by: _____

Date: _____ Phone No.:_____

To: Board of Trustees
Lamar Consolidated Independent School District
3911 Avenue I
Rosenberg, Texas 77271

Having examined Proposal and Contract Documents prepared by PBK, Inc., dated October 13, 2025, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

In submitting his Proposal, the undersigned agrees to the following:

1. Hold proposal open for acceptance 30 days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

I. BASE PROPOSAL

Undersigned agrees to complete the Work for the lump sum amount of:

_____Dollars $_____
(Amount written in words governs) (Amount in figures)

II. ALLOWANCES

Undersigned certifies that the specified allowances are included in the Base Proposal and agrees that any unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

III. CONTRACT TIME

Undersigned agrees to begin Work on December 17, 2025, and be Substantially Complete by March 8, 2027.

NOTE: THIS DOCUMENT IS FOR REFERENCE ONLY
AND MUST BE SUBMITTED VIA IONWAVE BY NOVEMBER 20, 2025.
BASE PROPOSAL DUE @ 2:00pm
ALTERNATE PROPOSALS DUE @ 3:00pm

IV. ADDENDA

Undersigned acknowledges receipt of Addenda Nos._____
dated _____, 20__.

V. ALTERNATES

If the Owner accepts any or all of the Alternates, the undersigned agrees to modify the Base Proposal as stipulated below:

A. Alternate No. 1: Three (3) Additional Classrooms

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

B. Alternate No. 2a: 23 09 23 – Direct Digital Controls – Unify Energy Solutions

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

C. Alternate No. 2b: 23 09 23 – Direct Digital Controls – Automated Logic Corportation

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

D. Alternate No. 2c: 23 09 23 – Direct Digital Controls – Climatec

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

E. Alternate No. 3a: 23 52 16 – Condensing Boilers by Hydrotherm KN Series and 23 51 00 Breechings, Chimneys and Stacks from GOES Heating

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

F. Alternate No. 3b: 23 52 16 – Condensing Boilers by Aerco and 23 51 00 Breechings, Chimneys and Stacks from Texas Air Systems.

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

G. Alternate No. 3d: 23 52 16 – Condensing Boilers by Camus and 23 51 00 Breechings, Chimneys and Stacks from Delta T Equipment.

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT IS FOR REFERENCE ONLY
AND MUST BE SUBMITTED VIA IONWAVE BY NOVEMBER 20, 2025.
BASE PROPOSAL DUE @ 2:00pm
ALTERNATE PROPOSALS DUE @ 3:00pm

H. Alternate No. 4a: 23 64 27 – Rotary Screw Water Chillers Air Cooled manufactured by Carrier (Copper/Aluminum Condenser Coils).

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

I. Alternate No. 4b: 23 64 27 – Rotary Screw Water Chillers Air Cooled manufactured by Carrier (Microchannel Condenser Coils).

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

J. Alternate No. 4c: 23 64 27 – Rotary Screw Water Chillers Air Cooled manufactured by Trane (Microchannel Condenser Coils).

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

K. Alternate No. 4d: 23 64 27 – Rotary Screw Water Chillers Air Cooled manufactured by JCI (Microchannel Condenser Coils).

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

L. Alternate No. 5a: 23 73 13 – Modular Indoor Central Station Air Handling Units and 23 63 13 – Air Cooled Refrigerant Condensers all manufactured by Carrier

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

M. Alternate No. 5b: 23 73 13 – Modular Indoor Central Station Air Handling Units and 23 63 13 – Air Cooled Refrigerant Condensers all manufactured by Trane

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

N. Alternate No. 5c: 23 73 13 – Modular Indoor Central Station Air Handling Units and 23 63 13 – Air Cooled Refrigerant Condensers all manufactured by Daikin

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

O. Alternate No. 5d: 23 73 13 – Modular Indoor Central Station Air Handling Units and 23 63 13 – Air Cooled Refrigerant Condensers all manufactured by JCI

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT IS FOR REFERENCE ONLY
AND MUST BE SUBMITTED VIA IONWAVE BY NOVEMBER 20, 2025.
BASE PROPOSAL DUE @ 2:00pm
ALTERNATE PROPOSALS DUE @ 3:00pm

P. Alternate No. 5e: 23 73 13 – Modular Indoor Central Station Air Handling Units and 23 63 13 – Air Cooled Refrigerant Condensers all manufactured by Temtrol and Aaon.

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

Q. Alternate No. 6a: 23 82 19.13 – Fan Coil Units – Carrier

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

R. Alternate No. 6b: 23 82 19.13 – Fan Coil Units – Trane

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

S. Alternate No. 6c: 23 82 19.13 – Fan Coil Units – JCI

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

T. Alternate No. 6d: 23 82 19.13 – Fan Coil Units – Aaon

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

U. Alternate No. 6e: 23 82 19.13 – Fan Coil Units – Enviro-tec

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

V. Alternate No. 7a: 26 50 00 – Light Fixture Package from CW Lighting

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

W. Alternate No. 7b: 26 50 00 – Light Fixture Package from Lesco

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

X. Alternate No. 8a: 26 09 43 – Digital Lighting Control solution from Wattstopper

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

Y. Alternate No. 8b: 26 09 43 – Digital Lighting Control solution from Acuity

ADD_____Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT IS FOR REFERENCE ONLY
AND MUST BE SUBMITTED VIA IONWAVE BY NOVEMBER 20, 2025.
BASE PROPOSAL DUE @ 2:00pm
ALTERNATE PROPOSALS DUE @ 3:00pm

VI. GENERAL CONTRACTOR'S PERSONNEL

A. Project Manager: _____

B. Superintendent:_____

C. Assistant Superintendent:_____

D. Project Engineer:_____

E. Other:_____

VII. CHANGES IN THE WORK

Undersigned understands that changes in the work shall be performed in accordance with the Supplementary Conditions.

VIII. LIQUIDATED DAMAGES

Undersigned understands that liquidated damages as defined in the Supplementary Conditions will be included in the form of Agreement between Owner and Contractor and that the contractor will be bound thereto.

IX. COST ESCALATIONS

This Proposal will be assumed to include all duties and tariffs applicable to the Cost of the Work that are in effect as of the date of the Proposal. Owner will not be responsible for the payment of any amounts attributable to duties or tariffs that were included in the Contract Sum but which were repealed, exempted or not actually incurred by the purchasing entity.

The Proposal should exclude any costs escalations resulting from duties or tariffs imposed after the date of pricing. Contractor agrees to notify Owner of any after-imposed duties or tariffs that will impact the cost of an item. In such event, unless the parties agree to an appropriate change in specifications to avoid or mitigate such costs, Contractor will be entitled to seek reimbursement for any necessary and demonstrated costs of after-imposed duties or tariffs, upon valid documentation thereof.

NOTE: THIS DOCUMENT IS FOR REFERENCE ONLY
AND MUST BE SUBMITTED VIA IONWAVE BY NOVEMBER 20, 2025.
BASE PROPOSAL DUE @ 2:00pm
ALTERNATE PROPOSALS DUE @ 3:00pm

It is understood that the right is reserved by the Owner to reject any or all proposals, or waive any informalities in the proposal process.

_____
Authorized Signature

_____
Title

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

_____
Name of Contracting Firm

_____
Address

_____
Telephone

_____
Date

END OF DOCUMENT 00 40 00

NOTE: THIS DOCUMENT IS FOR REFERENCE ONLY
AND MUST BE SUBMITTED VIA IONWAVE BY NOVEMBER 20, 2025.
BASE PROPOSAL DUE @ 2:00pm
ALTERNATE PROPOSALS DUE @ 3:00pm

DOCUMENT 00 40 00.1 – UNIT PRICE SUBMISSION FORM

MIDDLE SCHOOL 8
LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

Submitted by: _____

Date: _____ Phone No.:_____

To: Board of Trustees
Lamar Consolidated Independent School District
3911 Avenue I
Rosenberg, Texas 77271

Having examined Proposal and Contract Documents prepared by PBK, Inc., dated October 13, 2025, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the below-named unit prices for the corresponding costs listed below.

In submitting their Unit Price Submission Form, the undersigned agrees to the following:

1. Hold Unit Prices open for acceptance for 30 days.
2. Complete work in accordance with the Contract Documents within the stipulated contract time.
3. By signing, the undersigned affirms that, to the best of his knowledge, the Unit Prices have been arrived at independently and are submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.

III. UNIT PRICE

A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

B. Unit Price No. 2: Select Fill

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

C. Unit Price No. 3: Concrete

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

D. Unit Price No. 4: Grade Beam (Add)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT SHALL BE SUBMITTED WITH
PART 2: BASE PROPOSAL SUBMISSION (MIDDLE SCHOOL #8)
BY NOVEMBER 20, 2025 @ 2:00PM.

E. Unit Price No. 5: Grade Beam (Deduct)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

F. Unit Price No. 6: Drilled Pier (Add) (18”/48” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

G. Unit Price No. 7: Drilled Pier (Add) (24”/54” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

H. Unit Price No. 8: Drilled Pier (Add) (24”/60” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

I. Unit Price No. 9: Drilled Pier (Add) (30”/72” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

J. Unit Price No. 10: Drilled Pier (Add) (36”/84” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

K. Unit Price No. 11: Drilled Pier (Add) (42”/90” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

L. Unit Price No. 12: Drilled Pier (Add) (42”/96” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

M. Unit Price No. 13: Drilled Pier (Add) (42”/102” Belled Pier)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

N. Unit Price No. 14: Drilled Pier (Add) (18”/48” Belled Pier Poured as Straight Shaft)

ADD _____ Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT SHALL BE SUBMITTED WITH
PART 2: BASE PROPOSAL SUBMISSION (MIDDLE SCHOOL #8)
BY NOVEMBER 20, 2025 @ 2:00PM.

O. Unit Price No. 15: Drilled Pier (Add) (24”/54” Belled Pier Poured as Straight Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

P. Unit Price No. 16: Drilled Pier (Add) (24”/60” Belled Pier Poured as Straight Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

Q. Unit Price No. 17: Drilled Pier (Add) (30”/72” Belled Pier Poured as Straight Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

R. Unit Price No. 18: Drilled Pier (Add) (36”/84” Belled Pier Poured as Straight Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

S. Unit Price No. 19: Drilled Pier (Add) (42”/90” Belled Pier Poured as Straight Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

T. Unit Price No. 20: Drilled Pier (Add) (42”/96” Belled Pier Poured as Straight Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

U. Unit Price No. 21: Drilled Pier (Add) (42”/102” Belled Pier Poured as Straight Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

V. Unit Price No. 22: Drilled Pier (Deduct) (18”/48” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

W. Unit Price No. 23: Drilled Pier (Deduct) (24”/54” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

X. Unit Price No. 24: Drilled Pier (Deduct) (24”/60” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT SHALL BE SUBMITTED WITH
PART 2: BASE PROPOSAL SUBMISSION (MIDDLE SCHOOL #8)
BY NOVEMBER 20, 2025 @ 2:00PM.

Y. Unit Price No. 25: Drilled Pier (Deduct) (30”/72” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

Z. Unit Price No. 26: Drilled Pier (Deduct) (36”/84” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

AA. Unit Price No. 27: Drilled Pier (Deduct) (42”/90” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

BB. Unit Price No. 28: Drilled Pier (Deduct) (42”/96” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

CC. Unit Price No. 29: Drilled Pier (Deduct) (42”/102” Belled Pier)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

DD. Unit Price No. 30: Pier Casings (18” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

EE. Unit Price No. 31: Pier Casings (24” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

FF. Unit Price No. 32: Pier Casings (30” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

GG. Unit Price No. 33: Pier Casings (36” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

HH. Unit Price No. 34: Pier Casings (42” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT SHALL BE SUBMITTED WITH
PART 2: BASE PROPOSAL SUBMISSION (MIDDLE SCHOOL #8)
BY NOVEMBER 20, 2025 @ 2:00PM.

II. Unit Price No. 35: Pier Casings (48” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

JJ. Unit Price No. 36: Pier Casings (54” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

KK. Unit Price No. 37: Pier Casings (60” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

LL. Unit Price No. 38: Pier Casings (72” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

MM. Unit Price No. 39: Pier Casings (84” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

NN. Unit Price No. 40: Pier Casings (90” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

OO. Unit Price No. 41: Pier Casings (96” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

PP. Unit Price No. 42: Pier Casings (102” Pier Shaft)

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

QQ. Unit Price No. 43: Miscellaneous and structural steel

ADD _____Dollars $_____
(Amount written in words governs) (Amount in figures)

NOTE: THIS DOCUMENT SHALL BE SUBMITTED WITH
PART 2: BASE PROPOSAL SUBMISSION (MIDDLE SCHOOL #8)
BY NOVEMBER 20, 2025 @ 2:00PM.

_____
Authorized Signature

_____
Title

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

_____
Name of Contracting Firm

_____
Address

_____
Telephone

_____
Date

END OF DOCUMENT 00 40 00.1

NOTE: THIS DOCUMENT SHALL BE SUBMITTED WITH PART 2: BASE PROPOSAL SUBMISSION (MIDDLE SCHOOL #8) BY NOVEMBER 20, 2025 @ 2:00PM.

DOCUMENT 00 40 11 - FELONY CONVICTION NOTIFICATION

Note: <u>The Statement of Affirmation Must Be Notarized</u>

STATEMENT OF AFFIRMATION

"The undersigned affirms that he/she is duly authorized to provide this information by the person(s) or business entity making the bid, and the information provided below concerning felony convictions has been personally and thoroughly reviewed, and verified, and is, therefore, current, true and accurate to the best of my knowledge."

Firm's
Name:_____Address:_____

"a.____ My firm is a publicly held corporation, therefore, this reporting requirement is not applicable."
"b.____ My firm is not owned nor operated by anyone who has been convicted of a felony."
"c.____ My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:"

Name of Felon(s)
_____

Details of Conviction(s) _____

_____

PLEASE CHECK a, b, or c ABOVE AND SIGN BELOW

Offeror's
Name _____ Position/Title _____

Offeror's
Signature _____ Date _____

Subscribed and sworn to me on this _____ day of _____

_____
Notary Public

My Commission Expires: _____

END OF DOCUMENT 00 40 11

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

DOCUMENT 00 40 12 - LIST OF SUBCONTRACTORS

PROJECT:
Middle School 8

ARCHITECT:
PBK
11 Greenway Plaza, 22nd Floor
Houston, Texas 77046

ARCHITECT'S PROJECT NO. 240541

TO: [Contractor Name]
[Street}
[City, State Zip]

DATE: _____

List Subcontractors and others proposed to be employed on the above Project as required by the proposal documents.
(To be filled out by the Contractor and returned to the Architect.)

Work/ Division	Firm	Address	Phone	Fax	e-mail	Representative

(Provide additional sheets as required.)

END OF DOCUMENT 00 40 12

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PART 4: POST PROPOSAL

DOCUMENT 00 40 13 - AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

STATE OF TEXAS)
)
COUNTY OF)

AFFIDAVIT

This Company, Contractor, or Subcontractor agrees to refrain from discrimination in terms and conditions of employment to the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and rules and Regulations issued pursuant thereto in order to maintain and insure non-discriminatory employment practices.

_____
Company

_____
Printed Name

_____
Signature

STATE OF TEXAS)
)
COUNTY OF)

Sworn to and subscribed before me at _____, Texas, this the _____ day of _____, 20__.

_____
Notary Public in and for [ ] County, Texas

END OF DOCUMENT 00 40 13

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

DOCUMENT 00 40 14 - AFFIDAVIT OF NON-ASBESTOS, LEAD, AND PCB USE IN PROJECT

Upon completion of this form, return to the Architect upon close-out of the project.

PROJECT:
Middle School 8

ARCHITECT:
PBK Architects, Inc.
11 Greenway Plaza, 22nd Floor
Houston, Texas 77046

PBK PROJECT NO: 240541

CONTRACTOR: _____ DATE: _____

(Name, address) _____

_____

AFFIDAVIT

The undersigned affirms and certifies that "to the best of their knowledge and belief asbestos, lead, and PCB containing materials have not been used or incorporated into the Work and lead or lead bearing materials have not been incorporated into potable water systems", including, but not limited to those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibbs, as applicable to the project, and that lead sheet flashing used in through roof plumbing penetration applications is the only lead on the Project.

_____
Company

_____
Printed Name

_____
Signature

STATE OF TEXAS)
)
COUNTY OF _____)

Sworn to and subscribed before me at _____, Texas, this the _____ day of _____, 20__.

_____
Notary Public in and for _____ County, Texas

END OF DOCUMENT 00 40 14

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED AT PROJECT CLOSE-OUT

DOCUMENTS 00 40 17 - CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION

REVIEW BY CONTRACTOR-EMPLOYER

Certifying Affidavit submitted to:

Name of School District: _____

Mailing Address: _____
_____

Project: _____
_____

STATE OF TEXAS §

COUNTY OF §

(1) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to Lamar Consolidated Independent School District (the "District") that such firm has obtained, reviewed and verified, from a law enforcement or criminal justice agency or a private entity that is consumer reporting agency governed by the Fair Credit Reporting Act (15 U.S.C. §§ 1681 et seq.) the criminal history record information of all employees hired ***before January 1, 2008,*** who (a) have or will have continuing duties related to the contracted services, and (b) have or will be on school campuses. Such employees are identified by name on Schedule A attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule A have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(2) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to the District, that such firm has obtained, reviewed and verified, from the Texas Department of Public Safety criminal clearinghouse, the national criminal history record information of all employees hired ***on or after January 1, 2008,*** who (a) have or will have continuing duties related to the contracted services, and (b) be on school campuses. Such employees are identified by name on Schedule B attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule B have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(3) The undersigned firm swears and covenants that no present or future employee will provide services to the Project that involve direct contact with students unless and until such employee's national criminal history record information has been reviewed and cleared as required by Paragraph (2) above, and an updated Certification has submitted by the contracting firm to the District with an updated Schedule B identifying such employees. In the event of an emergency, an employee who has not been previously certified may only provide services that involve direct contact with students if such employee is escorted by a District representative.

(4) The undersigned firm swears and covenants that, upon receipt of information, directly or indirectly, that any employee of the contracting firm has been convicted of an offense identified in Section 22.085 of

the Texas Education Code, the contracting firm will immediately remove such employee from the Project and notify the District.

(5) Furthermore, the name, driver's license number, date of birth, and any other information required by the DPS will be submitted to the District for any person on either Schedule A or Schedule B for the purposes of subscribing to and issuing a District badge.

_____, being duly sworn, affirms and certifies that he/she is the

_____ (position) of _____(contracting

firm), and that all statements and acknowledgements contained herein are true and correct, and that he/she has the authority to bind such firm to the covenants set out above.

_____

SUBSCRIBED AND SWORN TO BEFORE ME this _____ day of _____, 20__.

Notary Public _____ State of _____

My Commission Expires: _____

END OF SECTION 00 40 17

DOCUMENT 00 40 18 - CONFLICT OF INTEREST QUESTIONNAIRE

INSTRUCTIONS

According to Local Government Code, Chapter 176, a person or an agent of a person who contracts or seeks to contract for the sale or purchase of property, goods, or services with Lamar Consolidated Independent School District must file a completed Conflict of Interest Questionnaire with the District Legal Department not later than the seventh business day after the date that the person begins contract discussions or negotiations with the District or submits to the District an application, response to a request for bids, correspondence, or another writing related to a potential agreement with the District.

This Conflict of Interest Questionnaire must be filed annually by September 1 as long as the person or the agent of the person continues to contract or seek to contract for the sale or purchase of property, goods, or services with the District or not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.

The completion of the Conflict of Interest Questionnaire is not needed if the person is an employee of a governmental entity and is acting in the employee's official capacity.

Explanation of the Conflict of Interest Questionnaire

1. Name of person doing business with the District.
2. Check the box if you are filing an update to a previously filed questionnaire.
3. Describe each affiliation or business relationship with an employee or contractor of the District who makes recommendations to a District officer with respect to expenditure of money. **If no affiliation or business relationship exists, state "NONE."**

   Examples:

   If your spouse, parent, or child is the District's Director of Purchasing and a bid is being submitted to the Purchasing Department, this relationship must be reported.

   If your spouse, parent, or child is the Principal at a School and your business may sell items directly to that school, this relationship must be reported.

   If you or your spouse, parent, or child is in business with a District employee that would be making a recommendation concerning a purchase or sales transaction involving you, the relationship must be reported.

   If you employ or do business with a spouse, parent, or child of a District employee that would be making a recommendation concerning a purchase or sales transaction involving you, the relationship must be reported.

   If you are a District employee and would be making a recommendation concerning a purchase or sales transaction involving you, the relationship must be reported.

   If your spouse, parent, or child is a teacher that does not make recommendations concerning purchasing or sales transactions, this relationship should not be reported.

   If your spouse, parent, or child is a Principal at a School and a bid is being considered by a separate department such as Facilities Planning (Construction Department), this relationship should not be reported.

4. Describe each affiliation or business relationship with a person who is a District officer and who appoints or employs a District officer that is the subject of this questionnaire. **If no affiliation or business relationship exists, state "NONE."**

Example:

If you or your spouse, parent, or child is related to, employs, or is in business with a District officer or their spouse, parent, or child, this relationship must be reported.

5. Name of District officer with whom you have an affiliation or business relationship.

   For each person listed under question #4, complete page 2. If answers to A, B, and C are NO, indicate the name of the District officer, but do not complete section D.

6. Describe any other affiliation or business relationship that might cause a conflict of interest.

   Example:

   If your neighbor or friend is a District employee that would be making a recommendation concerning a purchase or sales transaction involving you and you feel that your relationship with this employee could affect their recommendation, this relationship must be reported.

   If any other situation exists that would result in a conflict of interest, the relationship must be reported.

7. Sign and date this form.

Submit the completed form to the District. If any disclosures are indicated under questions #3 or #4, the form will be posted on the District's website.

INSERT CONFLICT OF INTEREST QUESTIONNAIRE

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor or other person doing business with local governmental entity

This questionnaire is being filed in accordance with chapter 176 of the Local Government Code by a person doing business with the governmental entity.

By law this questionnaire must be filed with the records administrator of the local government not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. *See* Section 176.006, Local Government Code.

A person commits an offense if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of person doing business with local governmental entity.**

2

☐ **Check this box if you are filing an update to a previously filed questionnaire.**

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than September 1 of the year for which an activity described in Section 176.006(a), Local Government Code, is pending and not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

3 **Describe each affiliation or business relationship with an employee or contractor of the local governmental entity who makes recommendations to a local government officer of the local governmental entity with respect to expenditure of money.**

4 **Describe each affiliation or business relationship with a person who is a local government officer and who appoints or employs a local government officer of the local governmental entity that is the subject of this questionnaire.**

Amended 01/13/2006

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ
Page 2

For vendor or other person doing business with local governmental entity

5 **Name of local government officer with whom filer has affilitation or business relationship. (Complete this section only if the answer to A, B, or C is YES.)**

This section, item 5 including subparts A, B, C & D, must be completed for each officer with whom the filer has affiliation or business relationship. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income from the filer of the questionnaire?

☐ Yes ☐ No

B. Is the filer of the questionnaire receiving or likely to receive taxable income from or at the direction of the local government officer named in this section AND the taxable income is not from the local governmental entity?

☐ Yes ☐ No

C. Is the filer of this questionnaire affiliated with a corporation or other business entity that the local government officer serves as an officer or director, or holds an ownership of 10 percent or more?

☐ Yes ☐ No

D. Describe each affiliation or business relationship.

6 **Describe any other affiliation or business relationship that might cause a conflict of interest.**

7

Signature of person doing business with the governmental entity

Date

Amended 01/13/2006

SAMPLE FORM 1295

CERTIFICATE OF INTERESTED PARTIES — FORM 1295

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

OFFICE USE ONLY

1 **Name of business entity filing form, and the city, state and country of the business entity's place of business.**

2 **Name of governmental entity or state agency that is a party to the contract for which the form is being filed.**

3 **Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the goods or services to be provided under the contract.**

4 Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 **Check only if there is NO Interested Party.** ☐

6 **AFFIDAVIT**

I swear, or affirm, under penalty of perjury, that the above disclosure is true and correct.

_____
Signature of authorized agent of contracting business entity

AFFIX NOTARY STAMP / SEAL ABOVE

Sworn to and subscribed before me, by the said _____, this the _____ day of _____, 20 _____, to certify which, witness my hand and seal of office.

_____ _____ _____
Signature of officer administering oath | Printed name of officer administering oath | Title of officer administering oath

ADD ADDITIONAL PAGES AS NECESSARY

Form provided by Texas Ethics Commission www.ethics.state.tx.us Adopted 10/5/2015

END OF DOCUMENT 00 40 20

NOTE: THIS DOCUMENT MUST BE SUBMITTED WITH PROPOSAL

INTERESTED PARTIES DISCLOSURE FORM 1295

DOCUMENT 00 50 00 - TEXAS STATUTORY PERFORMANCE BOND

Bond No.: _____

(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that: _____
(hereinafter called the Principal), as principal, and _____
a corporation organized and existing under the laws of the State of _____
authorized and admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter called the Surety), as Surety, are held and firmly bound unto

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

Dollars($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ day of _____, __ 20__, for

MIDDLE SCHOOL 8
LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas Government Code and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____day of _____, __ 20__.

(Seal)
_____

_____
Principal

_____
Surety Address

By: _____

(Seal)
_____
Surety Telephone Number

_____
Surety

By: _____
Attorney-in-Fact

END OF DOCUMENT 00 50 00

DOCUMENT BC

TEXAS STATUTORY PAYMENT BOND **Bond No.: _____**
(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that:_____
(hereinafter called the Principal), as principal, _____
a corporation organized and existing under the laws of the State of _____
authorized and admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter called the Surety), as Surety, are held and firmly bound unto

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the ____ day of _____,__20__, for

MIDDLE SCHOOL 8
LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all claimants supplying labor and material to him or a Subcontractor in the prosecution of the work provided for in said contract, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas Government Code and all liabilities on this bond to all such claimants shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____day of _____, __ 20__.

_____(Seal)
Witness: Principal

_____ By: _____

Witness: _____ (Seal)
Surety

_____ By: _____
Attorney-in-Fact

_____

_____ _____
Surety Address Surety Telephone Number

END OF DOCUMENT 00 50 01

SECTION 00 65 02 - WAIVER AND RELEASE OF LIENS

PART 1 - GENERAL

1.1 SUMMARY

A. Document Includes: Applicability and use of statutory Waiver and Release of Lien forms promulgated by the Legislature of the State of Texas for construction projects in Texas.

B. Related Requirements:
   1. The Contract for Construction (also referred to as the Agreement or the Contract)
   2. Conditions of the Contract (General, Supplementary, and other conditions, if any)
   3. Section 01 29 00 Payment Procedures
   4. Section 01 77 00 Contract Closeout
   5. Section 01 77 01 Closeout Procedures

1.2 REFERENCES

A. Texas Property Code, Chapter 53, Subchapter L, Sections 53.281 thru 53.287 (includes the standard forms attached herewith immediately following this section):
   1. Form 1: Conditional Waiver for Progress Payments
   2. Form 2: Unconditional Waiver for Progress Payments
   3. Form 3: Conditional Waiver for Final Payments
   4. Form 4: Unconditional Waiver for Final Payments

PART 2 PRODUCTS *(not used)*

PART 3 EXECUTION

3.1 SELECTION AND USE OF WAIVER AND RELEASE OF LIEN FORMS

A. Based on answers to the following questions, use the applicable form for the occasion:
   1. Is the payment a *progress* payment (partial, not final), or a *final* payment?
   2. Is the release *unconditional* (for a payment already received), or *conditional* (given in anticipation of a payment not yet received)?

B. Submit the applicable form, properly executed (filled out, signed and dated) and notarized, on each occasion required (see other portions of the Contract Documents, including but not necessarily limited to the related requirements documents cited above).

C. The wording of these forms is prescribed by the State of Texas. Questions regarding their use, execution, etc. should be directed to user's own attorney experienced in construction or lien law. This document is not to be interpreted as rendering legal advice.

D. Even if the Contract Documents do not explicitly require submittal of Waivers and Releases of Liens for every payment (for example, omitting them for monthly progress payments), the Owner reserves the right, at its sole discretion, to require applicable Waivers and Releases of Liens, executed and notarized, for any or all payments.

END OF SECTION 00 65 02
(see following pages for standard forms)

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of $_____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____ (owner) located at _____ (location) to the following extent:
_____ (job description).

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____
_____ (Company name)
By _____ (Signature)
_____ (Printed/Typed name)
_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This _____ day of _____, 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____ PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

The signer of this document has been paid and has received a progress payment in the sum of $_____ for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____ (Owner) located at _____ (location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent:

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____
_____ (Company name)
By _____ (Signature)
_____ (Printed/Typed name)
_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____ PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of $_____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____ (owner) located at _____ (location) to the following extent:

_____ (job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted).

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____ PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

The signer of this document has been paid in full for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____ (owner) located at _____ (location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____
_____ (Company name)
By _____ (Signature)
_____ (Printed/Typed name)
_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

(END OF ATTACHED FORMS)

DOCUMENT 00 70 00 - CONTRACT DOCUMENTS

I. CONSTRUCTION CONTRACT AGREEMENT

A. The contract for the construction of the project shall be executed by the successful Proposer on the 2017 Edition of AIA Document A101 "Standard Form of Agreement Between Owner and Contractor." Said contract, fully executed, shall be delivered to the Owner within ten (10) days of receipt of said contract.

II. CONDITIONS OF THE CONTRACT

A. The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, is hereby specifically made a part of the Contract Documents, whether attached hereto or not; and as supplemented and amended herein, constitutes the General Conditions.

B. Supplementary Conditions:
   1. The Supplementary Conditions contain modifications to the General Conditions of the Contract for Construction, AIA Document A201. Where any part of that document is modified by Supplementary Conditions, the unaltered provisions of the General Conditions shall remain in effect. Refer to Section CB for the Supplementary Conditions.

III. AVAILABILITY

A. Printed copies of these documents may be examined in the Architect's office. A.I.A. Documents may be obtained from the Houston Chapter of the American Institute of Architects, Capitol, Suite 120, Houston, Texas 77002; (713) 520-0155. Copies may also be obtained from local architects' supplies stores.

B. Failure to obtain and examine these documents in no way relieves the Contractor, Subcontractors, Sub-subcontractors, and material suppliers of responsibilities incorporated in the Agreement.

END OF DOCUMENT 00 70 00

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

New High School #8
FM 359
Fulshear, Texas 77441

THE OWNER:
(Name, legal status and address)

Lamar Consolidated Independent School District
3911 Avenue I
Rosenberg, Texas 77471

THE ARCHITECT:
(Name, legal status and address)

PBK Architects, Inc.
11 Greenway Plaza, 22nd Floor
Houston, Texas 77046

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ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

Init.
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14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

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ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

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§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These

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obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

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§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

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§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional,

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whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work,

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provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the

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Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

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§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

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§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

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§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- **.1** Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- **.2** Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

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.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

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§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

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.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

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§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;

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.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities

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proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the

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procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

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The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

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approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

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§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

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§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SUPPLEMENTARY CONDITIONS TO THE AIA DOCUMENT A201-2017 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201, Sixteenth Edition, 2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect. As appropriate, for purposes of this Request for Proposal, the term "Bid" shall mean "Proposal" and the term "Bidder" shall mean "Offeror", wherever they appear in the Construction Documents. The term "Contractor" shall include a Construction Manager-at-Risk.

ARTICLE 1 -- GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENT

Delete Section **1.1.1** in its entirety and substitute the following:

1.1.1 The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Performance Bond, Labor and Material Payment Bond, Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to propose, instructions to Proposers, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's Proposal or portions of Addenda relating to proposal requirements).

To the extent any provision in the Supplementary Conditions to these AIA Document A201-2017 General Conditions, issued by Owner, conflicts with any provision in the Supplementary Conditions issued by the Architect; the Supplementary Conditions to these AIA Document A201-2017 General Conditions issued by Owner shall control.

1.1.3 THE WORK

Add the following sentence at the end of this section:

It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following Sections:

1.2.1.2 Precedence of the Contract Documents: The most recently issued Document takes precedence over previous issues of the same Document. The order of precedence is as follows with the highest authority listed as "1".

.1 Contract Modifications (such as Change Orders) signed by the Contractor and Owner.
.2 The Agreement. (AIA Document A133-2009)
.3 The Supplementary Conditions
.4 The General Conditions of the Contract for Construction
.5 Addenda, with those of later date having precedence over those of earlier date
.6 Drawings and Specifications

Should these Documents disagree in themselves, the Architect and Owner will select the appropriate method for performing the Work, to facilitate avoiding increase in the Contract cost.

1.2.1.3 Relation of Specifications and Drawings: To be equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of Work indicated. In the event of the above mentioned disagreements, the resolution shall be determined by the Architect and Owner.

1.6 NOTICE

Delete the text of Section **1.6.1** in its entirety and substitute the following:

1.6.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer at the corporation for which is was intended, or if delivered at or sent by certified mail, or by registered or certified mail, or by courier service providing proof of delivery, to the last business address known to the party giving notice, or if delivered by facsimile or other electronic communications to the offices of the person or corporation for which it was intended. For facsimiles or other electronic communications received after 5:00 p.m. on a business day, or on a weekend or legal holiday on which the recipient's offices are closed, notice shall be deemed to have been duly served on the next business day.

Delete the text of Section **1.6.2** in its entirety.

Add Section **1.9** as follows:

1.9 MISCELLANEOUS OTHER DEFINITIONS

1.9.1 ADDENDA, ADDENDUM

Documents issued by the Architect prior to execution of the Owner Contractor Agreement for this Project that modify or clarify the Proposal Documents. All addenda become a part of the Contract Documents.

1.9.2 ALTERNATE PROPOSAL(S)

A separate amount stated on a separate Proposal Form which, if accepted by the Owner, will be added to or deducted from the Base Proposal. If accepted, the work that corresponds to the alternate proposal will become part of the agreement between Owner and Contractor. Alternate proposals shall remain valid for the same period of time as the Base Proposal after receipt of proposals, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

1.9.3 APPROVED, APPROVED EQUIVALENT, APPROVED EQUAL, OR EQUAL

The terms Approved, Approved Equivalent, Approved Equal, and Or Equal, relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.4.2, Substitution of Products and Systems, for procedures which must be followed after award of contract. The substitution procedure process to be followed prior to receipt of proposals is described in the Instructions to Bidders.

1.9.4 BASE PROPOSAL

The Contractor's proposal for the Work, not including any Alternates.

1.9.5 CONTRACT TIME

The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is subject to authorized adjustments as enumerated in the Contract Documents.

1.9.6 DATE OF AGREEMENT

The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted in the first page of the Agreement between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of Work.

1.9.7 DATE OF COMMENCEMENT OF THE WORK

The date of a written Notice to Proceed to the Contractor for a given portion of the Work. This date constitutes day zero (0) of the stated Contract Time. The Notice to Proceed will be issued after the District has received and validated the Contractor's Payment Bond, Performance Bond and Insurance.

1.9.8 DATE OF FINAL COMPLETION

The end of construction. See AIA Document A201-2017, Section 9.10.

1.9.9 DAY

The following days are referenced in the documents:

.1 Calendar Days. Extensions of time granted for Regular Work Days lost, if any, will be converted to Calendar Days.

.2 Holidays: The days officially recognized by the construction industry in this area as a holiday; normally limited to the observance days of New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the day after and Christmas Day.

.3 Regular Work Days: All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested on the basis of Regular Work Days, and those days, if approved, will be converted to calendar days by multiplying by a factor of one and four-tenths (1.4).

.4 **No extensions of the Contract Time will be granted due to inclement weather, except as provided in Section 8.3.1.**

1.9.10 NOTICE TO PROCEED

A notice that may be given by the Owner to the Contractor that directs the Contractor to start the Work. It may also establish the Date of Commencement of the Work.

1.9.11 PROVIDE

Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install".

1.9.12 PUNCH LIST

A comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be completed or corrected; this list may be supplemented by the Architect or Owner. See AIA Document A201, Section 9.8.

1.9.13 UNIT PRICES

A cost for a unit of work as described in the Contract Documents. The Owner may add or deduct Unit Price work at the amounts stated on the Proposal Form and such amounts shall not be subject to additional mark up by the Contractor or his subcontractors."

ARTICLE 2 – OWNER

2.1 GENERAL

Delete the text of Section **2.1.1** in its entirety and substitute the following:

2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. All parties understand that only the Board of Trustees for the Owner acting as a body corporate has the authority to bind the Owner with respect to all matters requiring the Board's approval under current policy of the Board of Trustees for the Owner, including, but

not limited to, Change Orders. Except as otherwise provided in Section 4.2.1, the Architect does not have authority to bind the Owner with respect to matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative.

Delete the text of Section **2.1.2** in its entirely.

2.2 EVIDENCE OF THE OWNER'S FINANCIAL ARRANGEMENTS

After the first sentence of Section **2.2.1,** delete the remainder of Section **2.2.1** in its entirety.

Delete Sections **2.2.2** and **2.2.3** in their entirety.

2.5 OWNER'S RIGHT TO CARRY OUT THE WORK

Delete the text of Section **2.5.** in its entirety and substitute the following:

If the Contractor defaults or neglects to carry out the work in accordance with the Contract Documents and fails, after receipt of written notice from the Owner, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the actual cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner within thirty (30) days of receipt of written notice from the Owner therefor.

Add Section **2.6** as follows:

2.6 OWNER'S LACK OF LIABILITY TO THIRD PARTY

2.6.1 The Owner is not responsible for the acts and/or omissions of, or contractually involved with, any subcontractors, suppliers of labor or materials, and/or their respective employees or agents or any other third-party claimants. Such claimants shall not constitute third party beneficiaries under this contract. The Contractor and/or his Surety solely shall deal with, take responsibility for, and be liable to such parties under this Contract. Contractor will indemnify and defend the Owner from any legal actions against Owner for unpaid bills of subcontractors.

Add Section **2.7** as follows:

2.7 OWNER'S RIGHT TO OCCUPY THE PROJECT

2.7.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time for completing the entire work or such portions may not yet have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents. If the Contractor determines that said occupancy may cause a delay to the completion of the project, he shall notify the Owner in writing immediately.

2.7.2 Refer to Article 11 Insurance and Bonds regarding property insurance requirements in the event of such occupancy.

2.7.3 If Contractor has not completed the obligations of the Contract Documents by the dates established by subsequent Amendments to the Agreement Between Owner and Construction Manager, the Owner shall have the right to occupy or use the entire project.

ARTICLE 3 -- CONTRACTOR

3.1 GENERAL

Add Section **3.1.4** as follows:

3.1.4 The Contractor must be fully qualified under any state or local licensing laws for Contractors in effect at the time and at the location of the work. The Contractor is responsible for determining that all of his subcontractors and prospective subcontractors are duly licensed in accordance with the law.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Delete the last sentence of Section **3.2.4** in its entirety and substitute the following:

If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities provided such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

Add Sections **3.2.5, 3.2.6** and **3.2.7** as follows:

3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work of all major subcontractors is complete.

3.2.6 If, in the opinion of the Architect, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of the duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to Sections 3.2.5, 3.2.6 and 3.7 before additional services are performed.

3.2.7 If the Contractor has knowledge that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor his Warranty, he shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes, including substitutions of materials, shall be accomplished by appropriate Modification.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Delete the last sentence of Section **3.3.1** in its entirety and substitute the following:

If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures, but only to the extent the Owner would be responsible for any such losses or damages under state and/or federal law.

Add Sections **3.3.4** and **3.3.5** as follows:

3.3.4 The Contractor is especially cautioned to coordinate the routing of mechanical and electrical items prior to commencing these operations.

3.3.5 Contractor shall bear sole responsibilities for design and execution of acceptable trenching and shoring procedures, in accordance with Texas Government Code, Section 2166.303 and Texas Health and Safety Code, Subchapter C, Sections 756.021, et seq. On trench excavations in excess of 5 feet in depth, Contractor shall pay a qualified engineer, experienced in the engineering design and preparation of drawings and specifications for compliance with state requirements for trenching and shoring, to prepare and professionally seal detailed drawings and specifications directing Contractor in the safe execution of trenching and shoring.

3.3.6 Any time that the Contractors' employees, subcontractors and their agents and employees, and other persons or entities performing portions of the work for or on behalf of the Contractor or any of its subcontractors are on site, the work shall be supervised by a qualified employee of the Contractor.

3.4 LABOR AND MATERIALS

Delete Section **3.4.2** in its entirety and replace it with the following:

3.4.2 The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

.1 If, after award of contract, the Contractor of one of his Subcontractors, or Suppliers determines that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Contractor shall promptly notify the Architect, in writing, providing detailed substantiation for his position. Any changes deemed necessary by the Owner and Architect, including substitution of materials and change in Contract Sum, either upward or downward, if any, shall be accompanied by appropriate Modification.

.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products on the Work in place of those specified only under the conditions set forth in specification referring to Product Options and Substitutions.

.3 Requests for substitution, received by the Architect later than forty five (45) days after "Notice to Proceed" or "Date of Commencement of the Work" (whichever occurs first), may result in additional costs to the Owner. Contractor agrees to reimburse the Owner through deductive Change Order to the Contract, for all costs associated with such requests.

.4 By making request for substitutions based on Subparagraph 3.4.2 above, the Contractor

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;

.2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;

.3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

.5 Substitution requests shall be submitted on the forms included herein and in accordance with the process established in specification referring to Product Options and Substitutions.

Add the following Sections after Section **3.4.3**

3.4.3 **.1** State law prohibits possession and/or use of alcohol and tobacco products on school property at all times.

.2 State law prohibits weapons or firearms on school property.

.3 There shall be zero tolerance for fraternization with students, teachers and any other school district personnel, Contractor will immediately remove any employee that violates this provision from the project.

.4 No glass bottles shall be brought on the construction site or Owner's property by any construction personnel.

3.5 WARRANTY

Delete the text of Section 3.5.1 in its entirety and substitute the following:

3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new, unless the Contract Documents require or permit otherwise. The contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect cause by abuse, material alteration to the Work not executed by the Contractor, insufficient maintenance or maintenance not in compliance with written instructions therefor, operation not in compliance with written instructions therefor, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

Add Sections **3.5.3, 3.5.4** and **3.5.5** as follows:

3.5.3 In the event of failure in the Work, including a specified product, whether during construction, or the correction period (which shall be one (1) year from the Date of Substantial Completion plus the time required to extend the warranty period until the next August 31, except where a longer period as specified), the Contractor shall take prompt and appropriate measures to assure correction or replacement of the defective Work or any portion thereof, including manufactured products, whether notified by the Owner or the Architect. Upon correction of warranty items, the Contractor shall provide the Owner and Architect with written notification of said correction. This obligation shall survive acceptance of the Work under the Construction Contract.

3.5.4 The Contractual Correction Period for this Project is one (1) year from the date of Substantial Completion plus the time required to extend the warranty period until the next August 31, except for any extended warranties as specified within the Contract Documents. Items of Work not completed until after the deadline for Substantial Completions shall have their warranties (general and any extended warranty periods) extended by the period of time between the deadline for Substantial Completion and the actual completion of the Work. Such warranties shall be submitted to the Owner in writing, documenting such time extensions. This correction period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the Work.

3.5.5 The Contractor shall accompany the Owner and Architect for a complete reinspection of the Project approximately eleven (11) months after the Date of Substantial Completion and shall promptly complete any observed or reported deficiencies in the Work, including any uncompleted Punch List items or outstanding and incomplete warranty items. The contractor shall provide written notification to the Owner and Architect when said Punch List items and/or additional deficiencies observed have been corrected. This obligation shall survive acceptance of the Work under the Construction Contract.

3.6 TAXES

Delete Section **3.6** in its entirety and substitute the following:

The Owner qualifies for exemption from State and Local Sales and Use Taxes pursuant to the provision of Article 20.04(f) of the Texas Limited Sales, Excise and Use Tax Act. Taxes normally levied on the purchase, rental and lease of materials, supplies and equipment used or consumed in performance of the Contract may be exempted by issuing to suppliers an exemption certificate in lieu of tax. Exemption certificates comply with State Comptroller of Public Accounts Ruling No. 95-0.07. Any such exemption certificate issued in lieu of tax shall be subject to State Comptroller of Public Accounts Ruling No. 95-0.09, as amended. Failure by the Contractor or Subcontractors to take advantage of the Owner's exemption and to obtain such exemption certificate shall make him responsible for paying taxes incurred on materials furnished on the Project without additional cost to or reimbursement by the Owner.

3.7 PERMITS, FEES, NOTICES AND COMPLIANCES WITH LAWS

After Section **3.7.1**, add the following Sections:

3.7.1 **.1** The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments and similar utility connection charges.

.2 The Contractor shall pay directly all temporary utility charges (excluding permanent power), utility district/company inspection fees, temporary tap charges, and temporary water meter charges and any other similar fees assessed by jurisdictional authority having control over this Project. The Contractor shall secure and pay for all governing authorities' permit fees.

.3 Fees payable to the Texas Department of Licensing and Regulation (TDLR) for document review relative to the Elimination of Architectural Barriers Act shall be paid by the Owner and the Architect will submit the documents to the TDLR for review and approval.

.4 The Contractor shall pay for all measures required for the SWPPP.

3.8 ALLOWANCES

Delete Section **3.8** in its entirety and substitute the following:

3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct and approve in writing. All unused allowance amounts shall be credited back to Owner, along with any markups included in the Contract Sum on such unused amounts.

3.9 SUPERINTENDENT

Delete Section 3.9.1 in its entirety and substitute the following:

3.9.1 The Contractor shall employ a competent superintendent, project manager and necessary assistants who shall be in attendance at the Project site during performance of the Work, including Punch List work. The superintendent and project manager shall represent the Contractor, and unless provided otherwise in Section 3.1.1, communications given to the superintendent or project manager shall be binding as if given to the Contractor.

Modify sections 3.9.2 & 3.9.3 to also include Project Manager as follows:

3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent and project manager. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent and project manager or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

3.9.3 The Contractor shall not employ a proposed superintendent and project manager to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent or project manager without the Owner's consent, which shall not unreasonably be withheld or delayed.

3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

Delete Section **3.10.1** and substitute the following:

3.10.1 Within 30 days of being awarded an Amendment, the Contractor shall prepare and submit for the Owner and Architect's review, a construction schedule for the Work, with critical path, schedule milestone dates, and Owner activities clearly defined. The schedule shall not exceed time limits current under the Contract Documents. For further schedule requirements refer to specification section regarding project schedules in the Project Manual.

Add Section **3.10.4** as follows:

3.10.4 The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add Section **3.11.1** as follows:

3.11.1 The Contractor shall post all Addenda on Construction Documents prior to commencing work in the site.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

At Section **3.12.5**, add the following Sections:

3.12.5 .1 If, in the opinion of the Architect, the Shop Drawings, Product Data, Samples and similar submittals are incomplete, indicate an inadequate understanding of the work covered by the submittals, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the submittals will be returned, unchecked, to the Contractor for correction of these three deficiencies and subsequent resubmittal. Additional service charges as outlined in 3.2.6 may be charged by the Architect in this event.

.2 The Architect will take no action on Shop Drawings, Product Data, and Samples that have not first been certified, by stamped, signed notation, as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.

At Section **3.12.7**, correct the word “approved” in the last line to read “accepted”.

At Section **3.12.8**, correct “Architect’s approval” in the last line to read “Architect’s acceptance”.

At Section **3.12.9**, correct “Architect’s approval” in the last line to read “Architect’s acceptance” and add the following Section:

3.12.9.1 Deviation from the requirements of the Contract Documents indicated on shop Drawings, Product Data, and Samples, does not constitute the required notification “in writing”.

Add Sections **3.12.11** and **3.12.12** as follows:

3.12.11 The Contractor shall submit complete Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents to the Architect at least thirty (30) days prior to the date the Contractor needs the reviewed submittals returned. Where colors are to be selected by the Architect, submit all Samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four weeks of the date of the contact for construction.

3.12.12 The Contractor shall submit digital PDF’s of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his consultants. Samples shall be submitted directly to the Architect for review.

Add Section 3**.12.13** as follows:

3.12.13 The Contractor shall provide MEP coordination drawings and MEP coordination models (BIM Services) within a schedule mutually agreed upon by the Team and prior to installing the Work, showing how all piping, ductwork, lights, conduit, equipment, etc. will fit into the ceiling space allotted, including clearances required by the manufacturer, by code, or in keeping with good construction practice. Space for all trade elements must be considered on the same drawing. Drawings shall be at ¼ inch per foot minimum scale and shall include invert elevations and sections required to meeting intended purpose. The

Contractor may propose an alternate method of accomplishing MEP coordination. If the alternate method is approved by the Team, it may be utilized.

3.14 CUTTING AND PATCHING

Add Section **3.14.3** as follows:

3.14.3 Leave all chases, holes and openings, straight and true, of proper size, and cut them into existing work as may be necessary for the proper installation of the work. Consult with all Subcontractors concerned, regarding proper locations and size. In case of conflict between requirement for cutting and patching and any other requirement of the Work, submit request for direction before proceeding with the Work. In case of failure to leave or cut them in the proper place, openings shall be cut afterward at no expense to the Owner. No excessive cutting will be permitted, nor shall any piers or other structural members be cut without prior approval. After such work has been installed, satisfactorily and carefully fit around, close up, repair, patch, and point up all cuts. Work shall be done with proper tools by workmen of the particular trade to which work belongs and shall be done without extra expense to the Owner. No description of specific cutting, patching, digging, etc., required for the work under a Specification Section that may be required for the proper accommodation of that work to the work of other trades shall relieve the Contractor from responsibility described above.

3.15 CLEANING UP

Add Section **3.15.3** as follows:

3.15.3 Prior to the Architect's inspection for Substantial Completion the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roof, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site.

3.18 INDEMNIFICATION

Delete Sections **3.18.1** and **3.18.2** in their entirety and replace them with the following:

3.18.1 TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES (COLLECTIVELY, THE "INDEMNIFIED PARTIES") FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH OF ANY EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF EVERY TIER, EVEN IF THE BODILY INJURY, SICKNESS, DISEASE OR DEATH IS CAUSED BY OR ALLEGED TO HAVE BEEN CAUSED BY THE NEGLIGENCE, FAULT OR STRICT LIABILITY OF ANY OF THE INDEMNIFIED PARTIES.

FOR ALL CLAIMS NOT ADDRESSED IN THE ABOVE PARAGRAPH, CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES AND (COLLECTIVELY, THE "INDEMNIFIED PARTIES"), FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, OF ANY NATURE WHATSOEVER ARISING OUT OF OR RELATED TO THIS AGREEMENT OR THE WORK TO BE PERFORMED UNDER THIS AGREEMENT, BUT ONLY TO THE EXTENT OF THE NEGLIGENCE OR OTHER FAULT OF THE CONTRACTOR, ITS AGENTS, REPRESENTATIVES, EMPLOYEES OR SUBCONTRACTORS OF ANY TIER.

3.18.2 It is understood and agreed that Subparagraph 3.18 above is subject to, and expressly limited by, the terms and conditions of TEX. CIV. PRACT. & REM. CODE ANN. 130.001-130.005 (Vernon Supp. 1989), as amended or modified, or any successor statute. Contractor shall not be obligated under

Subparagraph 3.18 to indemnify or hold harmless Architect or any agent, servant of employee of Architect from liability or damage that is caused by or results from:

.1 defects in plans, designs or specifications prepared, approved or used by the Architect; or

.2 negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and arises from:
- **.1** personal injury or death;
- **.2** property injury; or
- **.3** any other expense that arises from personal injury, death or property injury.

Add Section **3.18.3** as follows:

3.18.3 It is agreed with respect to any legal limitations, now or hereafter in effect and affecting the validity or enforceability of the indemnification obligation under Paragraph 3.18, such legal limitations are made a part of the indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligation shall continue in full force and effect.

Add Sections **3.19**, **3.20,** and **3.21** as follows:

3.19 RECORD DRAWINGS

3.19.1 Refer Owner's Closeout Procedures

3.20 PREVAILING WAGE RATES

3.20.1 As required by Chapter 2258 of the Texas Government Code Title 10 Prevailing Wage Rate, no employee used in this construction may be paid less than the minimum prevailing wage rate in effect for the Owner.

3.20.2 The Contractor and each Subcontractor and Sub-subcontractor shall pay to all laborers, workmen, and mechanics employed in execution of this Contract not less than rates set forth by law for each craft of type of workman or mechanic needed to execute this Contract.

3.20.3 Determination of prevailing wages shall not be construed to prohibit payment of more than the rates identified.

3.21 ANTITRUST VIOLATIONS

3.21.1 Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et.seq. (1973). The Contractor shall include this provision in his contracts with each Subcontractor and Supplier. Each Subcontractor shall include such provision in contracts with Sub-subcontractors and suppliers.

3.22 THIRD-PARTY BENEFICIARY

3.22.1 No person or entity shall be deemed to be a third-party beneficiary of any provision(s) of this Contract; nor shall any provision(s) hereof be interpreted to create a right of action or otherwise permit anyone not a signatory party to the Contract to maintain an action for personal injury or property damage.

ARTICLE 4 – ARCHITECT

4.2 Administration of the Contract

Delete Section **4.2.2** in its entirety and substitute the following:

4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed

about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the work, and (3) to determine in general if the work is being performed in a manner indicating that the work, when fully completed, will be in accordance with the Contract documents. The Architect will be required to make on-site inspections as necessary to keep the Owner informed of the progress of the Work and as necessary to guard the Owner against defects and deficiencies in the Work. The Architect will neither have control over or charge of, no be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

Delete Section **4.2.6** in its entirety and substitute the following:

4.2.6 The Architect shall have authority to reject Work that does not conform to the Contract Documents. The Architect shall be required to promptly notify the Owner of any non-conforming Work and shall reject such non-conforming Work unless the Owner objects to the rejection in writing within twenty-four (24) hours of such notification. Whenever the Architect considers it necessary or advisable for implementation of the intent of the Contract documents, the Architect will have authority to require inspection or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. Performance of any additional inspection or testing, which would result in additional cost to the Owner, shall require advance notice to and approval of the Owner. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work, except when the Contractor's inability to perform the Work is a result of design flaw, error or omission.

Add the following Section **4.2.8.1**:

4.2.8.1 Allowance Expenditure will be authorized using Allowance Expenditure authorizations (AEA) executed by the Owner, the Architect and the Contractor. All Allowance Expenditure Authorizations, if not already within Contract, will be incorporated into the contract by Change Order at the completion of the project. Work authorized by an AEA may be invoiced as it is completed.

Delete Section **4.2.13** in its entirety and substitute the following:

4.2.13 All decisions on matters relating to aesthetic effect shall initially be made by the Architect; however, all such decisions are subject to the Owner's written approval.

ARTICLE 5 – SUBCONTRACTORS

5.1 DEFINITIONS

At the end of Section **5.1.1** add the following sentence:

Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.

At the end of Section **5.2.4**, add the following sentence:

Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed changes.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

Delete the last sentence of Section **5.4.1** in its entirety and substitute the following:

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, but only to the extent permitted by law.

Delete the last sentence of Section **5.4.3** in its entirety.

ARTICLE 7 -- CHANGES IN THE WORK

7.1 GENERAL

Delete the text of Section **7.1.2** in its entirety and substitute the following:

7.1.2 A Change Order shall be based on agreement among the Owner, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4.1 or the Owner's assessment of liquidated damages as allowed by the Contract Documents. A Construction Change Directive requires agreement by the Owner or the Owner's representative and Architect, and may or may not be agreed to by the Contractor; an order for a minor change may be issued by the Architect alone.

Add Section **7.5** as follows:

7.5 ALLOWABLE MARKUPS FOR CHANGES IN THE WORK

7.5.1 If the Change provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.5.2 through 7.5.6

7.5..2 Unless otherwise directed, the procedure and markup of the costs for additional work shall be determined in the following manner:

.1 Upon Change Proposal request, the Contractor shall quote the cost for changes in the work showing separately, credits and additional costs broken down by headings used in the Schedule of Values. Further breakdown into units of labor and materials may be required if agreement on cost cannot be reached using the breakdown by headings. The final cost shall be the amount of the Total Contract Value Change shown on the Change Proposal signed by the Contractor and Owner. For general construction work, not subcontracted, the Contractor shall consider as costs the actual invoice amount for additional materials, the sales tax on additional materials when applicable, the wages paid for additional direct labor, plus the Contractor's usual markup of wages to cover additional labor related costs such as insurance, taxes and fringe benefits.

.2 On changes executed within the Owner's Contingency Allowance, Contractor's Contingency Allowance, or other allowances contained within the contract, Contractor shall have included costs for combined overhead and profit, to the extent permitted by the Contract Documents, and General Conditions costs, including the cost of superintendents, field office expense, temporary facilities and services, small hand tools, construction equipment not specifically provided for the change in hand, home office expense, bond and building insurance premiums, and managing the Subcontractor's work, in his Base Contract amount. Allowed overhead and profit fee on Owner's Contingency Allowance changes to be included in the total cost to the Owner shall be based as follows:

.1 For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's of Sub-subcontractor's own forces, a maximum of fifteen percent (15%) of the cost.

.2 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, a maximum of five percent (5%) of the amount due the Sub-subcontractors.

7.5.3 If any additional Work is authorized outside of or in excess of the Owner's Contingency Allowance, the combined overhead and profit for this work shall be based as follows:

.1 For the Contractor, for Work performed by the Contractor's own forces, a maximum total markup of ten percent (10%) of the actual cost on a lump sum project, or the Contractor's Construction Phase Fee on a Guaranteed Maximum Price Project.

.2 For Work performed by the Contractor's Subcontractor(s), a maximum of five percent (5%) of the amount due the Subcontractor(s).

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor's own forces, a maximum markup of ten percent (10%) of the actual cost.

.4 For each Subcontractor, for work performed by the Subcontractor's Sub-subcontractors, a maximum of five percent (5%) of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.4

7.5.4 In order to facilitate checking of quotations for extras or credits, all proposals, (except those so minor that their propriety can be seen by inspection), shall be accompanied by a complete and detailed itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

7.5.5 Change orders, as they are accepted by the Owner, shall be entered under heading "Change Orders" in the next current Request for Payment.

7.5.6 All credits to or deductions from the Contract Sum, a Contingency or an Allowance shall be calculated using the same methodology set forth in this Section 7.5. All unused Contingency or Allowance amounts shall be credited back to Owner prior to final payment, along with any markups included in the Contract Sum or GMP on such unused amounts.

ARTICLE 8 -- TIME

8.1 DEFINITIONS

At Section **8.1.4**, add the following sentence:

See further definition of "Day" in Section **1.9.10**.

8.3 DELAYS AND EXTENSIONS OF TIME

Delete Section **8.3.1** in its entirety and substitute the following:

8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other unforeseeable causes beyond the Contractor's control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine. **No extensions of the Contract Time will be granted for inclement weather, except for Force Majeure weather events consisting of named storms or government declared emergencies resulting from extreme weather.**

Add Sections **8.3.4** and **8.3.5** as follows:

8.3.4 The parties hereto agree that time is of the essence of this Contract and that pecuniary damages would be suffered by the Owner if the Contractor does not substantially complete all Work called for in the Contract Document by the specified date, which damages are, by their very nature, difficult of ascertainment. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the final payment made to the Contractor a sum equal to the

amount stated stated in the Contract Documents, per phase for each and every Calendar Day beyond the agreed date which the contractor has agreed to for Substantial Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially completed within the agreed time, or with the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only, and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. **The liquidated damages assessed herein shall be Owner's sole remedy for time delays between the deadline for substantial completion and Contractor's achievement of substantial completion.**

8.3.5 Failure to complete and close-out the Project, and complete all Punch List items, within sixty (60) days after the scheduled Substantial completion date will additionally entitle the Owner to deduct from the final payment made to the Contractor a sum equal to the amount stated in the Contract Documents, per phase, for each and every Calendar Day beyond the 60-day close-out period. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Project close-out does not occur on a timely basis. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. If the Contractor is delayed through no fault of the Owner, the Substantial Completion is not achieved by the agreed contract completion date, the Project close-out period of sixty (60) days will not be extended by the number of days of delay past the actual Substantial completion date and will remain based upon the agreed contract completion date.

ARTICLE 9 -- PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

Add Section **9.1.1.1** as follows:

9.1.1.1 The Owner is exempt from payment of Texas State Sales Tax on materials required for the Work. Therefore, to comply with the law, the Contract Sum shall be broken down into the amount of cost for labor and the amount of cost for materials. This breakdown shall be provided by the Contractor within ten (10) days of award of Contract.

9.2 SCHEDULE OF VALUES

Add the following Sections:

9.2.1 General Contractor's cost for Contractor's fee, bonds and insurance, Individual General Conditions, etc., shall be listed as individual line items.

9.2.2 Schedule of Values shall break each line into materials and labor. Once approved by the Owner and Architect, it shall be used as basis for reviewing Application for Payment but not be taken as evidence of market or other value.

9.2.3 Contractor's cost for various construction items shall be detailed. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, paving, etc. These subdivisions shall appear as individual line items**.**

9.2.4 On major subcontracts, such as mechanical, electrical, and plumbing, the Schedule shall indicated line items and amounts in detail, (for example; underground, major equipment, fixtures, installation of fixtures, start up, etc.)

9.2.5 Costs for subcontract work shall be listed without any addition of General Contractor's costs for overhead, profit or supervision.

9.2.6 The Contractor shall include a value for the coordination documents/drawings on the schedule of values.

9.2.7 The Contractor shall include a value for the correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant on the schedule of values for each sub-contractor subject to commissioning and test, adjust and balance requirements.

9.3 APPLICATIONS FOR PAYMENT

Delete Sections **9.3.1** and **9.3.2** in their entirety and replace them with the following:

9.3.1 Refer to Section 7.1.3 of the A133 Agreement for timelines related to Applications for Payment.

9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

9.3.2 Payments will be made on account of materials or equipment 1) incorporated in the Work; 2) suitably stored at the site; or 3) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

.1 The location must be agreed to, in writing, by the Owner and Surety.

.2 The location must be a bonded warehouse.

.3 Surety must agree, in writing, to each request for payment.

.4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment, without prior written approval of Owner.

The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.

Add Section **9.3.4** as follows:

9.3.4 The Contractor shall submit requests for payment, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702, Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

9.6 PROGRESS PAYMENTS

Delete Section **9.6.1** in its entirety and substitute the following:

9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make progress payments in accordance with the following Section and Section 7.1.3 of the A133.

.1 Based upon the applications for payment and supporting documents submitted to the Architect by the Contractor and certification of the amount payable by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the Contract Documents for the period covered by the application for payment:

.2 Applications for Payment shall be submitted by the last day of the month. Not later than the last day of the following month, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing (subject to the conditions listed in Article 9.3.2 of the Supplementary Conditions to the Contract for Construction), for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner.

.3 Upon Substantial Completion of the entire Work, a sum sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for all incomplete Work and unsettled claims as provided in the Contract Documents.

At Section **9.6.2**, insert the following sentence between the first and second sentence:

More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent (5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub-subcontractors.

9.7 FAILURE OF PAYMENT

Delete the phrase “or awarded by binding dispute resolution.” Replace all references to “seven days” to “ten days.”

9.8 SUBSTANTIAL COMPLETION

At Section **9.8.2**, add the following sentence at the end:

Should the Architect determine that the Contractor’s List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and inspection for determining the Date of Substantial Completion will be delayed until the List submitted is a reasonable representation of the work to be done.

Add Sections **9.8.6** and **9.8.7** as follows:

9.8.6 In order for the project or a major portion thereof to be considered substantially complete, the following conditions must be met:

.1 All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.

.2 All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner’s opinion, cause interference to the Owner’s use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

The following items are a partial specific list of requirements, as applicable to the Project, that must be completed prior to established Substantial Completion of all portions of the work (Including the Substantial Completion of the commissioning phase).

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
3. All exterior clean-up and landscaping must be complete.
4. All final interior clean-up must be complete.
5. All HVAC air and water balancing must be complete.
6. All required commissioning must be complete.

7. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
8. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
9. All final lockset cores must be installed and all final Owner directed keying completed.
10. All room plaques and exterior signage must be completed.
11. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
12. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.

9.8.7 After the date of Substantial Completion of the Project is evidenced by the Certificate of Substantial Completion, the Contractor will be allowed a period of time within which to correct all deficiencies attached to the Certificate of Substantial Completion as outlined in Section 8.3.4 of these supplementary conditions. Failure of the Contractor to complete such corrections within the stipulated time will be reported to the contractor's surety. In this report, the Contractor and surety will be informed that, should correction remain incomplete for fifteen (15) days, the Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with Article 14.2.

.1 Should corrective work following Substantial Completion require more than one reinspection after notification by the Contractor that corrections are complete, the cost of subsequent inspections may also be deducted from the Contract funds remaining unpaid to the Contractor.

9.10 FINAL COMPLETION AND FINAL PAYMENT

At Section **9.10.2**, add the following sentence **at the end**:

Prior to final payment, the Contractor shall meet all of the requirements of Owner's Closeout Procedures.

Add Section **9.10.6** as follows:
9.10.6 Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor, provided the Work has then been completed, the Contract fully performed, all Contract Close Out Documents have been submitted, the Final Certificate for Payment has been issued by the Architect and Board of Trustees has accepted the Project as complete. The final payment will not be made until all of these conditions have been satisfied.

ARTICLE 10 -- PROTECTION OF PERSONS AND PROPERTY

Add Sections **10.2.9** and **10.2.10** as follows:

10.2.9 The performance of the foregoing services by the Contractor shall not relieve the Subcontractors of their responsibilities for the safety of persons and property and for compliance with all applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to the conduct of the Work.

10.2.10 The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

10.3 HAZARDOUS MATERIALS

Delete the text of Section **10.3.1** in its entirety and substitute the following:

10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site

by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Section 10.3.2.

Delete the text of Sections **10.3.3, 10.3.4** and **10.3.5** in their entirety.

Delete the text of Section **10.3.6** in its entirely and substitute the following:

10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a governmental agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all costs and expenses thereby incurred, but only to the extent provided by law.

Add Section **10.3.7** as follows:

10.3.7 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials.

ARTICLE 11 -- INSURANCE AND BONDS

Delete the text of Sections 11.1 through 11.5 and substitute the following Sections:

11.1 CONTRACTOR'S LIABILITY INSURANCE

The Owner reserves the right to review the insurance requirements during the effective period of any Contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by Owner based upon changes in statutory laws, court decisions or potential increase in expense to loss.

11.2 The Owner requires the following minimum insurance coverages:

Types of Coverage	Limits of Liability	
Commercial General Liability	General Aggregate	$2,000,000.00
	Products/Completed Operations/Aggregate	$1,000,000.00
	Bodily Injury and Property Damage (each)	$1,000,000.00
	Contractual	$1,000,000.00
	Personal and Advertising Injury	$1,000,000.00
	Fire Damage	$500,000.00
	Medical Expense	$5,000.00

11.2.1 The Owner shall be named as an additional insured on a primary and non-contributory basis using form CG 2010 10 01 or similar endorsement providing equal or greater coverage in favor of the Owner.

Coverage shall include the following:
(a) Premises operations;
(b) Blanket Contractual Liability;
(c) Pollution;
(d) Products/Completed Operations;
(e) Broad Form Property Damage;
(f) Independent Contractors;
(g) Per project aggregate limit;
(h) Provide a statement of claims against the aggregate limit with each renewal certificate;

(i) X,C,U exclusions to be removed when underground work is performed; and
(j) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.2.2 Automobile Liability — Combined Single Limit — $1,000,000.00

(a) Comprehensive Automobile Liability Insurance to cover all vehicles owned by, hired by, or used on behalf of Contractor.

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.2.3 Workers' Compensation — Statutory Limits

(a) Coverage at Statutory Limits with All States Endorsement

(b) Employer's Liability	Each Accident	$1,000,000.00
	Disease (Policy Limit)	$1,000,000.00
	Disease (Each Employee)	$1,000,000.00

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.2.4 Excess or Umbrella Insurance (provides coverage in excess of primary Commercial General Liability, Automobile Liability, and Worker's Compensation Coverage B limits)

(a) Minimum coverage for the Contractor shall be one (1) times the Contract amount, subject to a minimum limit of $1,000,000.00 and a maximum limit of $25,000,000.00. Limits for primary policies may differ from those shown above when Excess (Umbrella) Insurance coverage is provided.

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.3 The Owner requires that the following insurance requirements be satisfied:

.**1** No Work shall be commenced until all insurance requirements set forth in this Agreement have been approved by the Owner in writing.

.**2** All insurance policies and certificates required hereunder shall be in form and content satisfactory to the Owner.

.**3** The Owner shall be furnished an ACORD form Certificate of Insurance evidencing all policies and endorsements required by this Agreement prior to execution of the Contract and thereafter upon renewal or replacement of each required policy of insurance.

.4 Each Insurance coverage/policy shall contain a provision that at least thirty (30) days prior written notice shall be given to the Owner in the event of cancellation, material change, or non-renewal.

.5 Insurance shall be underwritten by a company licensed to do business in Texas, satisfactory to Owner and rated minimum A-VII by A.M. Best.

.6 The insurance coverages specified herein shall be maintained at all times during the term of the contract and, with the exception of builder's risk coverage, shall be maintained for a minimum of one (1) year thereafter.

.7 No deletions/exclusions from the standard coverage form are allowed without the prior written consent of the Owner.

.8 All insurance must be issued on an occurrence basis.

.9 The Contractor shall be responsible for all deductibles; the Owner shall approve the deductibles selected.

.10 With the exception of Excess Umbrella Coverage, the coverage afforded by each carrier must be a primary over any other applicable insurance.

.11 In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the Owner as Additional Insured, and (b) showing waivers of subrogation in favor of the Owner.

11.4 PERFORMANCE BOND AND PAYMENT BOND

Add the following Sections:

11.4.1 The Contractor shall provide a Performance Bond, in the penal sum equal to one hundred percent (100%) of the Contract Sum, if the formal Contract is in excess of One Hundred Thousand Dollars ($100,000.00) and a Labor and Material Payment bond, in the penal sum equal to one hundred percent (100%) of the Contract sum if the formal contract is in excess of Twenty Five Thousand Dollars ($25,000.00).

11.4.2 The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an attached authorized power of attorney. Such Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of a least A-X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570).

11.4.3 The Performance Bond Form and the Payment Bond Form included herein shall be executed and submitted to the Architect in duplicate prior to commencement of the work. The surety companies must be acceptable to the Owner and licensed admitted carriers in the State of Texas; and the companies must appear in a current Federal Treasury list as Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds land as Acceptable Reinsuring companies.

11.4.4 Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copies of each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

11.4.5 Claims must be sent to the Contractor and his Surety in accordance with Article 5160, Revised Civil Statutes. The Owner will furnish in accordance with such Article, a copy of the Payment Bond as provided therein to claimants upon request. All claimants are cautioned that no lien exists on the funds unpaid to the contractor on such Contract, and that reliance on notices sent to the Owner may result in loss of their rights against the Contractor and/or his Surety. The Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no responsibility because of any representation by any agent or employee.

11.5 WORKER'S COMPENSATION INSURANCE COVERAGE

11.5.1 Comply with the requirements of Rule 28, TAC §110.110, Reporting Requirements for Building or Construction Projects for Governmental Entities

11.5.2 DEFINITIONS:

.1 Certificate of coverage ("certificate"). A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing service as on a project, for the duration of the project.

.2 Duration of the project –includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

.3 Persons providing services on the project ("subcontractor" in §406.096)-includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity which furnishes persons to provide services on the project. "Services" include without limitation, providing hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply delivery, and delivery of portable toilets.

11.5.3 The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

11.5.4 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

11.5.5 If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

11.5.6 The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

.1 A certificate of coverage, prior to that person beginning work on the projects so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project, and

.2 No later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

11.5.7 The Contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

11.5.8 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

11.5.9 The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Worker's Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack coverage.

11.5.10 The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

.1 Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meet the statutory requirements of Texas Labor code,

Section 401.011(44) for all of its employees providing services on the project, for the duration of the project.

.**2** Provide the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project.

.3 Provide the Contractor, prior to the end of the coverage period shown on the current certificate ends during the duration of the project.

.**4** Obtain from each other person with whom it contracts, and provides to the Contractor:

.1 A certificate of coverage, prior to the other person beginning work on the project, and

.2 A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

.5 Retain all required certificates of coverage on file for the duration of the project and for one year thereafter.

.**6** Notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project, and

.7 Contractually require each person with whom it contracts, to perform as required by these subsections (1)-(7), with the certificates of coverage to be provided to the person for whom they are providing services.

11.5.11 By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other actions.

11.5.12 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

ARTICLE 12—UNCOVERING AND CORRECTION OF WORK

12.2.1 BEFORE SUBSTANTIAL COMPLETION

After Section **12.2.1** add the following Sections:

12.2.1.1 In the event of failure of a specified project, either during construction or the correction period, the Contractor shall take appropriate measures with the manufacturer of the product to assure correction or replacement of the defective products.

12.2.1.2 Refer to Owner's Closeout Procedures for further terms regarding warranties which will be required prior to final payment.

12.2.2 AFTER SUBSTANTIAL COMPLETION

After Section **12.2.2.1** add the following Section:

12.2.2**.**1.1Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an "end of the one year correction period" reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor.

12.3 ACCEPTANCE OF NONCONFORMING WORK

Number the existing provision as Section **12.3.1**, and add Section **12.3.2** as follows:

12.3.2 The Owner's use and/or occupancy of any or all of the Project site shall never be construed as an acceptance of Work not in conformance with Contract Documents. The Owner reserves the right to enforce provisions of the Contract unless the Owner's acceptance is provided to the Contractor in writing.

ARTICLE 13—MISCELLANEOUS PROVISIONS

Add Sections **13.6**, **13.7 and 13.8** as follows:

13.6 EQUAL OPPORTUNITY

13.6.1 The contractor shall maintain policies of employment as follows:

.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

13.7 CRIMINAL BACKGROUND CHECKS

The Contractor/Subcontractor shall certify that all employees' fingerprints and information necessary for the Criminal Background Check has been submitted to DPS, as stated in the form included herein, as required by Texas Education Code Section 22.08341 and Texas Administrative Code Section 153.1101 and 153.1101(7), and shall comply with all requirements of such laws in the event Owner notifies Contractor/Subcontractor that such Crimianl Background Check reflects offenses prohibited by law.

13.8 REQUIRED CERTIFICATIONS

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law. Contractor hereby certifies and verifies that neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

Contractor hereby represents and warrants that: (1) it does not, and will not for the duration of the contract, boycott energy companies or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

Contractor hereby represents and warrants that: (1) it does not, and will not for the duration of the contract, have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

ARTICLE 14—TERMINATION OR SUSPENSION OF THE CONTRACT

Delete the text of Section 14.1.3 in its entirety and substitute the following:

14.1.3 If one of the reasons described in Section 14.4.1 or 14.4.2 exists, the Contractor may, upon seven day's written notice to the Ower and Architect, terminate the Contract and recover from the Owner payment for Work executed as of the date of the notice, plus costs of demobilization.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

Delete the text of Section **14.4.3** in its entirety and substitute the following:

14.4.3 In the case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed up to date of receipt of the notice of termination, plus costs of demobilization.

ARTICLE 15—CLAIMS AND DISPUTES

15.1 CLAIMS

Delete the text of Section **15.1.1** in its entirety and substitute the following:

15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner, Architect, and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. Nothing herein shall require the Owner to make or file a Claim in order to assess liquidated damages provided for in the Contract Documents.

15.1.2 TIME LIMITS ON CLAIMS

Delete the last sentence of Section **15.1.2** in its entirety.

15.1.3 NOTICE OF CLAIMS

Delete the second sentence of Section **15.1.3** in its entirety and substitute the following:

Claims by either party must be initiated within ninety (90) days after occurrence of the event giving rise to such Claim or within ninety (90) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

15.1.6 CLAIMS FOR ADDITIONAL TIME

Delete the text of **Section 15.1.6.2** in its entirety and substitute the following:

15.1.6.2 No extenstions of the Contract Time will be granted for inclement weather, except as provided in Section 8.3.1.

15.1.7 CLAIMS FOR CONSEQUENTIAL DAMAGES

Delete the text of Section **15.1.7** in its entirety.

15.2 INITIAL DECISION

Delete the text of Section **15.2.1** in its entirety and substitute the following:

15.2.1 Claims, excluding those alleging an error or omission by the Architect or those arising after expiration of the period for correction of the Work, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the

Agreement. If the parties are unable to agree, any claim, dispute or matters arising out of the contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

Delete the text of Section **15.2.5** in its entirety and substitute the following:

15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefore; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties, but subject to mediation, if both parties so agree, and subject to legal or equitable proceedings in a court having jurisdiction thereof. It is understood and agreed that, in the event that any dispute, controversy, or conflict arises during the design and construction of the Project or following its completion, the parties hereto will cooperate in good faith, if possible, to resolve the issues without resorting to litigation.

Delete the text of Sections **15.2.6** and **15.2.6.1** in their entirety.

Add the following Section **15.2.9**

15.2.9 The prevailing party in any judicial proceeding arising from the Contract Documents shall recover its reasonable and necessary attorneys' fees.

15.3 MEDIATION

15.3.1 Delete the text of **15.3.1** in its entirety.

Delete Section **15.3.2** in its entirety and replace with the following:

15.3.2 The parties may mutually agree to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing unless stayed for a longer period of agreement of the parties or court order.

15.4 ARBITRATION

Delete the text of Sections **15.4.1** through **15.4.3** and **15.4.4.1** through **15.4.4.3** in their entirety.

END OF DOCUMENT

SECTION 00 73 19 - SAFETY REQUIREMENTS

A. This section applies to all Contractor's personnel, including but not limited to Subcontractors, Sub-subcontractors, vendors, suppliers, and inspectors.

B. The following Safety Requirements are to be adhered too on all Lamar CISD Projects along with OSHA requirements and all required safety regulations. Where there is a conflict, the most stringent requirement shall govern.

C. OSHA Requirements:
   1. Conform to OSHA Requirements of 29CFR 1926 & applicable sections of 29CFR 1910
   2. Conform to all State and Local Regulations and Requirements that are applicable

D. Above OSHA Requirements:
   1. Accident Reporting – Must be timely and properly documented within 24 hours of the accident or incident.
   2. "Baker" Scaffolding – Guardrail required at 4'-0" above working surface.
   3. Clothing – Shirts with sleeves, long pants, substantial work shoes or boots, no vulgar or inappropriate shirts are allowed.
   4. Confined Spaces – Procedures, testing, and training in accordance with OSHA 1910.146
   5. Controlled Substances (including alcohol) are prohibited on the job site.
   6. Cranes – Independent 3rd party inspection by an agency accredited by USDOL, OSHA under the regulations of Title 29, Chapter XVIII, Part 1919
   7. Discipline Program –Verbal Warning, Written Warning, Dismissal
   8. Electrical Cords and Tools –Assured Equipment Grounding Program required
   9. Emergency Procedures – Compliance mandatory
   10. Fall Protection (Steel Erection) 100% Tie off shall be the primary means of fall protection
   11. Fall Protection (Precast Concrete) 100% Tie off shall be the primary means of fall protection.
   12. Fall Protection 9A written fall protection program will be required of all contractors
   13. Fighting – Prohibited on the job site; offenders shall be dismissed immediately.
   14. Hazard Communication – Haz Com Program and Material Safety Data Sheets are required
   15. Hot Work – Permits and a dedicated Fire Watch required for all operations.
   16. Housekeeping – Combustible scrap materials & debris must be removed daily.
   17. Immediate Danger to Safety or Health – Work shall be stopped immediately.
   18. Job Hazard Analysis – Must be created prior to mobilization and strictly followed for all work.
   19. Orientation Session – All Employees must attend before starting work at any project site.
   20. Personal Protective Equipment – Hard Hats & Safety Glasses required at all times.
   21. Return to Work – Restricted Duty to be made available to the extent allowed by the doctor.
   22. Safety Representative – Must meet requirements of the Competent Person Standard and have completed an OSHA 10 hour construction outreach training.
   23. Scaffolding – Inspection & Documentation required daily by a Competent Person.
   24. Training – Weekly "Tool-Box" Safety meetings to be performed with a signed attendance roster.
   25. Weapons – Possession of weapons on the project site is prohibited.
   26. Lamar CISD strictly enforces "No Tobacco Products" on school property.

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH EXECUTED CONTRACT

E. Site Safety Orientation
   1. The Contractor shall perform site safety orientation with all employees working on the Project prior to their beginning any work. In addition to the above safety requirements, the following criteria shall be addressed and emphasized in the orientation. A log of each employee's attendance with signature of participant and employer shall be kept and made available to the Owner and Architect at all times.
   2. Emphasis shall be placed on protection of the students:
      a. School speed zones
      b. Access to building, badges, stickers, etc.
      c. No over head work when children are present.
      d. No Alcohol/drugs/guns on premises
      e. Times when students arrive/leave to co-ordinate construction activities

   3. Do's and Don'ts for the construction worker covering topics, such as:
      a. Proper clothing (no explicit words/pictures/sayings)
      b. Proper footwear
      c. Material Safety Data Sheets
      d. Fall Protection
      e. Housekeeping
      f. Gloves
      g. Respiratory protection, etc

By signature of this document, I hereby state that I (or designated representative of this Company as indicated below) have reviewed the project sites, reviewed the Contract Documents and read the Specifications including the General Conditions, Supplementary Conditions and Special Owner Requirements in their entirety and do fully understand and agree to fully abide by all requirements established herein.

Respectively Submitted,

By: _____
Signature

_____
Name

_____
Title

_____
Company Name

_____
Street Address

_____
City, State, Zip Code

(Seal - if Proposer is a corporation)
NOTE: Form must be notarized and attached to the Construction Contract.

END OF SECTION 00 73 19

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH EXECUTED CONTRACT

Prevailing Wage Rate
Determination Information

The following information is from Chapter 2258 Texas Government Code:

Sec. 2258.021. Right to be Paid Prevailing Wage Rates.

(a) A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:
    (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
    (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.
(b) Subsection (a) does not apply to maintenance work.
(c) A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

Sec. 2258.023. Prevailing Wage Rates to be paid by Contractor and Subcontractor; Penalty.

(a) The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.
(b) A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.
(c) A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section 2258.022.
(d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.
(e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

Sec. 2258.051. Duty of Public Body to Hear Complaints and Withhold Payment.

A public body awarding a contract, and an agent or officer of the public body, shall:

(1) take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and
(2) withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without a determination by the public body that there is good cause to believe that the contractor has violated this chapter.

NOTE: Lamar CISD will request certified payroll from trades at random times throughout the life of the project to verify Prevailing Wage Rates compliance.

Prevailing Wage Rates – School Construction Trades

June 1, 2022

Texas Gulf Coast Area

CLASSIFICATION	2022 HOURLY RATE
ASBESTOS WORKER	$22.17
BRICKLAYER; MASON	$25.32
CARPENTER; CASEWORKER	$23.38
CARPET LAYER; FLOOR INSTALLER	$25.12
CONCRETE FINISHER	$23.40
DATA COMM/TELE COMM	$23.50
DRYWALL INSTALLER; CEILING INSTALLER	$27.56
ELECTRICIAN	$25.93
ELEVATOR MECHANIC	$31.13
FIREPROOFING INSTALLER	$22.38
GLAZIER	$22.30
HEAVY EQUIPMENT OPERATOR	$22.33
INSULATOR	$20.50
IRONWORKER	$27.33
LABORER, HELPER	$16.71
LATHERER; PLASTERER	$23.25
LIGHT EQUIPMENT OPERATOR	$20.50
METAL BUILDING ASSEMBLER	$23.25
MILLWRIGHT	$33.63
PAINTER; WALL COVERING INSTALLER	$19.60
PIPEFITTER	$26.97
PLUMBER	$26.71
ROOFER	$20.50
SHEET METAL WORKER	$21.67
SPRINKLER FITTER	$26.13
STEEL ERECTOR	$23.25
TERRAZZO WORKER	$23.50
TILE SETTER	$19.58
WATERPROOFER; CAULKER	$19.88

This document was developed by PBK Architects, Inc., in strict accordance with Chapter 2258 of the Texas Government Code.

Prevailing Wage Rates

Worker Classification Definition Sheet

CLASSIFICATION	DEFINITION
ASBESTOS WORKER	Worker who removes and disposes of asbestos materials.
BRICKLAYER; MASON	Craftsman who works with masonry products, stone, brick, block, or any material substituting those materials and accessories.
CARPENTER; CASEWORKER	Worker who build wood structures or structures of any material which has replaces wood. Includes rough and finish carpentry, hardware and trim.
CARPET LAYER; FLOOR INSTALLER	Worker who installs carpets and /or floor coverings, vinyl tile.
CONCRETE FINISHER	Worker who floats, trowels, and finishes concrete.
DATA COMM/TELE COMM	Worker who installs data/telephone and television cable and associate equipment and accessories.
DRYWALL; CEILING INSTALLER	Worker who installs metal framed walls and ceiling, drywall coverings, ceiling grids, and ceilings.
ELECTRICIAN	Skilled craftsman who installs or repairs electrical wiring and devices. Includes fire alarm systems and HVAC electrical controls.
ELEVATOR MECHANIC	Craftsman skilled in the installation and maintenance of elevators.
FIREPROOFING INSTALLER	Worker who sprays or applies fire proofing materials.
GLAZIER	Worker who installs glass, glazing, and glass framing.
HEAVY EQUIPMENT OPERATOR	Includes but not limited to: all CAT tractors, all derrick-powered, all power operated cranes, back-hoes, back-fillers, power operated shovels, winch trucks, and all trenching machines.
INSULATOR	Worker who applies, sprays, or installs insulation.
IRONWORKER	Skilled craftsman who erects structural steel framing, and installs structural concrete Rebar.
LABORER, HELPER	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials or tools, hauling, digging, clean up.
LATHERER; PLASTERER	Worker who installs metal framing and lath. Worker who applies plaster to lathing and installs associated accessories.
LIGHT EQUIPMENT OPERATOR	Includes but not limited to , air compressors, truck crane drivers, flex planes, building elevators, form graders, concrete mixers less than 14cf), conveyers.
METAL BUILDING ASSEMBLER	Worker who assembles pre-made metal buildings.
MILLWRIGHT	Mechanic specializing in the installation of heavy machinery, conveyance, wrenches, dock levelers, hydraulic lifts, and align pumps.
PAINTER; WALL COVERING INSTALLER	Worker who prepares wall surfaces and applies paint and/or wall coverings, tape, and bedding.
PIPEFITTER	Trained worker who installs piping systems, chilled water piping and hot water (boiler) piping, pneumatic tubing controls, chillers, boilers, and associated mechanical equipment.
PLUMBER	Skilled craftsman who installs domestic hot and cold water piping, waste piping, storm system piping, water closets, sinks, urinals, and related work.
ROOFER	Worker who installs roofing materials, Bitumen (asphalt and coal tar) felts, flashings, all types of roofing membranes, and associated products.
SHEET METAL WORKER	Worker who installs sheet metal products, Roof metal, flashings and curbs, ductwork, mechanical equipment, and associated metals.
SPRINKLER FITTER	Worker who installs fire sprinklers systems and fire protectant equipment.
STEEL ERECTOR	Worker who erects and dismantles structural steel frames of buildings and other structures.
TERRAZZO WORKER	Craftsman who places and finishes Terrazzo
TILE SETTER	Worker who prepares wall and/or floor surfaces and applies ceramic tiles to these surfaces.
WATERPROOFER; CAULKER	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membranes, and liquid membranes, sprayed, rolled or brushed.

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Phased construction.
   4. Work by Owner.
   5. Work under separate contracts.
   6. Purchase contracts.
   7. Owner furnished products.
   8. Owner furnished, Contractor installed products.
   9. Access to site.
   10. Coordination with occupants.
   11. Work restrictions.
   12. Specification and drawing conventions.
   13. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: Middle School 8
   1. Project Location: TBD

B. Owner: Lamar Consolidated Independent School District
   1. Owner's Representative: Scot Hartfiel, Project Manager

C. Architect: PBK Architects, Houston, Texas.

D. Consultants: Additional design professionals have been retained who have prepared designated portions of the Contract Documents.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following: New 103,245 sqft. middle school for Lamar Consolidated Independent School District for up to 750 students and 50 administrative staff. Project includes two wings of classrooms, science labs, collaborative/flexible use areas, administrative suite, a centralized library, a fine arts wing, kitchen, locker rooms, and a cafetorium and gymnasium with a combine/divide function through the use of an operable partition wall. Project includes all civil, mechanical, electrical, plumbing, technology, foodservice, and structural components needed to provide a complete, fully functional building.

B. Type of Contract: Project will be constructed under a competitive sealed proposal (CSP) contract.

1.5 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

A. Cooperate fully with Owner so Work may be carried out smoothly, without interfering with or delaying the work or work by Owner. Coordinate the Work with Work performed by Owner.

B. The Owner reserves the right to let separate contract for Work outside of the scope of this Contract. Cooperate fully with separate contractors so Work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with Work performed under separate contracts.

C. Purchase Contracts: The Owner reserves the right to negotiate purchase contracts with suppliers of material and equipment that may be incorporated into the Work. The Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
   1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

D. Owner Furnished, Contractor Installed Products (OFCI): The Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections when applicable.
   1. Owner Furnished Products: Coordinate with Owner.

1.6 ACCESS TO SITE

A. Use of Site: Limit use of Project site to Work in areas and areas within the Contract limits indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
   1. Limits: The drawings indicate the limits of the construction operations.
   2. Driveways, Walkways, and Entrances: Keep driveways. parking areas, student drop off and pick up points, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, the students, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in weathertight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform Work to prevent interference with Owner's day to day operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
   2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided occupancy does not interfere with completion of

the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, ensure mechanical and electrical systems are fully operational, and required tests and inspections and start up procedures are successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. Upon occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.8 WORK RESTRICTIONS

A. Work Restrictions: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On Site Work Hours: Limit Work in the existing building to normal working hours, Monday through Friday, unless otherwise indicated. Coordinate with Owner when it is necessary to extend working hours or Work on weekends.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:
1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
2. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than two weeks in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Controlled Substances, Firearms, and Explosive Devices: Use of tobacco products, controlled substances, firearms, and explosive devices on the site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on site.
1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
3. Interior work performed during the academic school year shall be performed outside of normal working hours so as to not disrupt building operations. All associated costs pertaining to performing work outside of normal working hours shall be included in the contractor’s base proposal.

B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of each specification section.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. The Owner has a critical need for the Work to begin upon Notice to Proceed and shall be Substantially Complete by **March 8, 2027.** There will be No Extensions of Time due to weather.

END OF SECTION 01 10 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include:
   1. Lump sum allowances.
   2. Unit cost allowances.
   3. Quantity allowances.
   4. Contingency allowances.
   5. Testing and inspecting allowances.

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.4 LUMP SUM, UNIT COST, AND QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight**,** and delivery to site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.5 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation**,** taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.6 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.7 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit cost allowances.
   4. Owner reserves the right to establish the quantity of Work in place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related Work.

3.3 SCHEDULE OF ALLOWANCES

A. Owner's Contingency Allowance: $800,000.00
   1. Contractor shall include the amount indicated below in his Base Proposal as a contingency to cover the cost of hidden, concealed or otherwise unforeseen conditions which develop during completion of the work. Contractor shall be allowed to recover all costs associated with the completion of work under this contingency, however, no overhead or profit will be allowed.

B. Super Graphic Allowance: $90,000.00
   1. Contractor shall include the amount indicated above in their base proposal for the cost of purchasing, delivering, and installing the digitally printed vinyl murals on this project. All other room signs, post-and-panel signs, and exterior aluminum lettering shall be included in the base proposal and are not a part of this allowance.

C. Phone and Network Equipment, Installation, and Integration Allowance: $90,000.00
   1. Contractor shall include the amount indicated above in their Base Proposal for the cost of purchasing, delivering, installing, and integrating all project related network and phone equipment; including but not limited to switches, uninterruptable power supplies, wireless access points, actual telephone systems, and handsets. All conduits, circuits, structured cabling, and materials otherwise needed for a complete installation are to be included in the base bid.

D. Camera Equipment, Installation, and Integration Allowance: $135,000.00
   1. Contractor shall include the amount indicated above in their Base Proposal for the cost of purchasing, delivering, installing, and integrating the cameras in the Project. All conduits, circuits, structured cabling, and materials otherwise needed for a complete installation are to be included in the base bid.

E. Access Control Equipment, Installation, and Integration Allowance: $80,000.00
   1. Contractor shall include the amount indicated above in their Base Proposal for the cost of purchasing, delivering, installing, and integrating a complete and functional access control system. Provide all appurtenances required for a complete access control system, including but not limited to the following: head-end units, control modules, card readers, access cards, door contacts, and cabling. Conduits, electrical circuits, terminations, door hardware, and materials otherwise needed for a complete, turn-key installation are to be included in the base bid.

F. New Gas Service Entrance Allowance: $50,000.00
   1. Contractor shall include the amount indicated above in their Base Proposal for the cost of providing a new gas service entrance for the project.

G. New Electrical Service Entrance Allowance: $50,000.00
   1. Contractor shall include the amount indicated above in their Base Proposal for the cost of providing a new electrical service entrance for the project.

H. Emergency Responder Antenna Allowance: $80,000.00
   1. Contractor to carry an allowance within the project for a building-wide distributed antenna system (DAS) that can be utilized for emergency first responders. The base bid of the project has scope for the contractor to install the headend equipment and backbone wiring between equipment, but this allowance will cover the distributed antenna devices and wiring from the headend units throughout the building as needed to provide a complete functioning system. The base bid, not this allowance, covers the contractor to perform tests of the building at completion of construction to verify where signal strength may need to be amplified which would then define the scope of work that this allowance would fund.

I. Casing for Piers Allowance: $250,000.00

1. Contractor shall provide an allowance for 100% casing of drilled piers. Contractor shall also provide unit price for each size of casing utilized on the project. Payment for casing shall be based upon the “Pier Casings” unit price in “01 22 00 – UNIT PRICES” specifications. Refer to the “Drilled Belled Piers” notes on “S-303– GERNEAL FOUNDATION NOTES AND TYP DETAILS” for more information. Use of this allowance shall be supported by unit price and time-and-materials documentation.

J. Wet Weather Site Conditions Allowance (Building Pad): $165,000.00

1. The contractor shall provide an allowance for the removal of wet, weak soil and replace with select fill, properly compacted should the on-site soils become wet and weak, and unable to support construction equipment after or during a rainy season or rain events. Payment for removal and replacement of wet / weak soils shall be based upon the ‘Removal of unsatisfactory soil and replacement with satisfactory soil material’ unit price in “01 22 00 – UNIT PRICES” specifications. Refer to the “Wet Weather / Soft Subgrade Considerations (Constructability)” notes as well as the “Allowance Notes for Wet Weather Mitigation” notes on “S-013 – GENERAL SUBGRADE NOTES AND TYP DETAILS” for more information. Use of this allowance shall be supported by unit price and time-and materials documentation.

K. Wet Weather Site Conditions Allowance (Access Roads / Laydown Areas): $35,000.00

1. The contractor shall provide an allowance for the removal of wet, weak soil and replace with select fill, properly compacted should the on-site soils become wet and weak, and unable to support construction equipment after or during a rainy season or rain events. Payment for removal and replacement of wet / weak soils shall be based upon the ‘Removal of unsatisfactory soil and replacement with satisfactory soil material’ unit price in “01 22 00 – UNIT PRICES” specifications. Refer to the “Wet Weather / Soft Subgrade Considerations (Constructability)” notes as well as the “Allowance Notes for Wet Weather Mitigation” notes on “S-013 – GENERAL SUBGRADE NOTES AND TYP DETAILS” for more information. Use of this allowance shall be supported by unit price and time-and materials documentation.

END OF SECTION 01 21 00

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
   1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
   2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.
   1. Description: Unsatisfactory soil excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 312000 "Earth Moving."
   2. Unit of Measurement: Cubic yard of soil excavated, based on survey of volume removed. Cost shall include all materials, labor, overhead and profit for complete installation satisfactory soil material.

3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. Unit Price No. 2: Select Fill
1. Description: This Unit Price shall be the entire unit cost including overhead and profit for one (1) cubic yard of new select fill material, delivered, spread, and compacted per plans and specs. Cost shall include all materials, labor, overhead and profit for complete installation of select fill. Enter unit cost on Proposal Form.

C. Unit Price No. 3: Concrete
1. Description: This unit price shall be the entire unit cost including overhead and profit for one (1) cubic yard of new concrete material, delivery, labor for installation/ placement, formwork, etc per plans and specs. Reinforcement for concrete shall also be included and shall be assumed to be 2% minimum by volume. Enter unit cost on Proposal Form.

D. Unit Price No. 4: Grade Beam (Add)
1. Description: This Unit Price shall be the entire unit cost including overhead and profit for the addition of one (1) linear foot of grade beam of each grade beam size utilized in the project per the grade beam schedule on S-302. Cost shall include all materials, labor, detailing, overhead and profit for complete installation of grade beam. Enter unit cost for each grade beam size on Proposal Form.

E. Unit Price No. 5: Grade Beam (Deduct)
1. Description: This Unit Price shall be the entire unit cost including overhead and profit for the removal of one (1) linear foot of grade beam of each grade beam size utilized in the project per the grade beam schedule on S-302. Cost shall include all materials, labor, detailing, overhead and profit for complete installation of grade beam. Enter unit cost for each grade beam size on Proposal Form.

F. Unit Price No. 6: Drilled Pier (Add) (18”/48” Belled Pier)
1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 18”/48” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

G. Unit Price No. 7: Drilled Pier (Add) (24”/54” Belled Pier)
1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 24”/54” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

H. Unit Price No. 8: Drilled Pier (Add) (24”/60” Belled Pier)
1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 24”/60” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

I. Unit Price No. 9: Drilled Pier (Add) (30”/72” Belled Pier)
1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 30”/72” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

J. Unit Price No. 10: Drilled Pier (Add) (36”/84” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 36”/84” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

K. Unit Price No. 11: Drilled Pier (Add) (42”/90” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 42”/90” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

L. Unit Price No. 12: Drilled Pier (Add) (42”/96” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 42”/96” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

M. Unit Price No. 13: Drilled Pier (Add) (42”/102” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 42”/102” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

N. Unit Price No. 14: Drilled Pier (Add) (18”/48” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 18”/48” drilled pier to be poured as a straight shaft, using the bell diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

O. Unit Price No. 15: Drilled Pier (Add) (24”/54” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 24”/54” drilled pier to be poured as a straight shaft, using the bell diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

P. Unit Price No. 16: Drilled Pier (Add) (24”/60” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 24”/60” drilled pier to be poured as a straight shaft, using the bell diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

Q. Unit Price No. 17: Drilled Pier (Add) (30”/72” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 30”/72” drilled pier to be poured as a straight shaft, using the bell diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

R. Unit Price No. 18: Drilled Pier (Add) (36”/84” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 36”/84” drilled pier to be poured as a straight shaft, using the bell

diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

S. Unit Price No. 19: Drilled Pier (Add) (42”/90” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 42”/90” drilled pier to be poured as a straight shaft, using the bell diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

T. Unit Price No. 20: Drilled Pier (Add) (42”/96” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 42”/96” drilled pier to be poured as a straight shaft, using the bell diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

U. Unit Price No. 21: Drilled Pier (Add) (42”/102” Belled Pier Poured as Straight Shaft)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the addition of one (1) 42”/102” drilled pier to be poured as a straight shaft, using the bell diameter and reinforcing steel as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

V. Unit Price No. 22: Drilled Pier (Deduct) (18”/48” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 18”/48” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

W. Unit Price No. 23: Drilled Pier (Deduct) (24”/54” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 24”/54” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

X. Unit Price No. 24: Drilled Pier (Deduct) (24”/60” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 24”/60” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

Y. Unit Price No. 25: Drilled Pier (Deduct) (30”/72” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 30”/72” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

Z. Unit Price No. 26: Drilled Pier (Deduct) (36”/84” Belled Pier)
   1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 36”/84” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

AA. Unit Price No. 27: Drilled Pier (Deduct) (42”/90” Belled Pier)
1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 42”/90” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

BB. Unit Price No. 28: Drilled Pier (Deduct) (42”/96” Belled Pier)
1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 42”/96” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

CC. Unit Price No. 29: Drilled Pier (Deduct) (42”/102” Belled Pier)
1. Description: This Unit Price shall be the entire unit cost, including overhead and profit, for the removal of one (1) 42”/102” drilled pier using the reinforcing as shown in 1/S-303. Cost shall include all materials, labor, detailing, overhead and profit for complete installation. Enter unit cost for drilled pier size on Proposal Form.

DD. Unit Price No. 30: Pier Casings (18” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for an 18” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

EE. Unit Price No. 31: Pier Casings (24” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 24” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

FF. Unit Price No. 32: Pier Casings (30” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 30” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

GG. Unit Price No. 33: Pier Casings (36” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 36” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

HH. Unit Price No. 34: Pier Casings (42” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 42” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

II. Unit Price No. 35: Pier Casings (48” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 48” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

JJ. Unit Price No. 36: Pier Casings (54” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 54” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

KK. Unit Price No. 37: Pier Casings (60” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 60” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

LL. Unit Price No. 38: Pier Casings (72” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 72” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

MM. Unit Price No. 39: Pier Casings (84” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for an 84” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

NN. Unit Price No. 40: Pier Casings (90” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 90” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

OO. Unit Price No. 41: Pier Casings (96” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 96” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

PP. Unit Price No. 42: Pier Casings (102” Pier Shaft)
1. Description: The contractor shall provide a unit price for casing for a 102” drilled pier shaft as shown on 1/S-303. Cost shall include all materials, labor, overhead and profit, delivery, and costs associated with delay of schedule for complete installation.
2. Unit of Measurement: Net length of casing utilized multiplied by the unit price.

QQ. Unit Price No. 43: Miscellaneous and structural steel
1. Description: Miscellaneous lintels and other supports not otherwise indicated in the Contract Documents, according to Section 051200 "Structural Steel Framing" and Section 055000 "Metal Fabrications." This unit price shall be the entire unit cost including overhead and profit for one (1) pound of fabricated steel as indicated on the itemized invoice of steel supplier and verified by the Architect. Cost shall include all materials, labor, detailing, engineering, erection, overhead and profit for complete installation. Enter unit cost on the Proposal Form.

END OF SECTION 01 22 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: Administrative and procedural requirements for the Alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain Work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. Alternates described are part of the Work when enumerated in the Agreement.
   2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent Work as necessary to completely integrate Work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Forty-eight (48) hours following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other Work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 ALTERNATES

A. Alternate Number 1: Three (3) Additional Classrooms
   1. This Alternate shall establish the amount to be added to the Base Proposal for the complete construction of approximately 2,569 square feet to house three (3) additional classrooms. This cost shall include the furnishment and installation of all applicable building elements included in the Construction Documents associated with this Alternate, including but not limited to; concrete foundations, super structure, roof, MEPT systems, power, data, lighting, and architectural construction with finishes. If this alternate is not accepted; the edge of the

building, wall, slab, brick, and windows/storefronts, canopies, and roof edge shall be reduced to the structural bay near and along column grid lines 'CP' & 'CQ' in Area C.

B. Alternate Number 2a: 23 09 23 – Direct Digital Controls – **Unify Energy Solutions**
   1. This Alternate shall establish the amount to adjust the Base Proposal for the cost of furnishing and installing Direct Digital Controls manufactured by Reliable Controls – Installed by **Unify Energy Solutions**. This alternate shall include the pricing for all materials and labor for proper completion. Refer to specs and drawings for additional information.

C. Alternate Number 2b: 23 09 23 – Direct Digital Controls – **Automated Logic Corporation**
   1. This Alternate shall establish the amount to adjust the Base Proposal for the cost of furnishing and installing Direct Digital Controls manufactured by Automated Logic Corporation – Installed by **ALC – Houston**. This alternate shall include the pricing for all materials and labor for proper completion. Refer to specs and drawings for additional information.

D. Alternate Number 2c: 23 09 23 – Direct Digital Controls – **Climatec**
   1. This Alternate shall establish the amount to adjust the Base Proposal for the cost of furnishing and installing Direct Digital Controls manufactured by Alerton Installed by **Climatec**. This alternate shall include the pricing for all materials and labor for proper completion. Refer to specs and drawings for additional information.

E. Alternate Number 3a: 23 52 16 – Condensing Boilers by **Hydrotherm KN Series and 23 51 00 Breechings, Chimneys and Stacks from GOES Heating**.
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Condensing Boilers, manufactured by **Hydrotherm** and Breechings, Chimney's and Stacks provided by **GOES Heating** as shown and scheduled on the drawings and as specified. Alternate boiler price shall include warranty as specified per 1.9.

F. Alternate Number 3b: 23 52 16 – Condensing Boilers by **Aerco and 23 51 00 Breechings, Chimneys and Stacks from Texas Air Systems**.
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Condensing Boilers, manufactured by **Aerco** and Breechings, Chimney's and Stacks provided by **Texas Air Systems** as shown and scheduled on the drawings and as specified. Alternate boiler price shall include warranty as specified per 1.9.

G. Alternate Number 3c: 23 52 16 – Condensing Boilers by **Camus and 23 51 00 Breechings, Chimneys and Stacks from Delta T Equipment**.
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Condensing Boilers, manufactured by **Camus** and Breechings, Chimney's and Stacks provided by **Delta T Equipment** as shown and scheduled on the drawings and as specified. Alternate boiler price shall include warranty as specified per 1.9.

H. Alternate Number 4a: 23 64 27 – Rotary-Screw Water Chillers Air-Cooled manufactured by **Carrier (Copper / Aluminum Condenser Coils).**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Rotary-Screw Water Chillers Air-Cooled, manufactured by **Carrier** as shown and scheduled on the drawings and as specified. Alternate chiller price shall include (5) five-year parts, labor, refrigerant, etc. extended warranty (re: 1.11 Warranty) and (5) five-year preventative maintenance contract (re: 1.12 Preventative Maintenance Service) as specified; there are no chillers included in the base bid.

I. Alternate Number 4b: 23 64 27 – Rotary-Screw Water Chillers Air-Cooled manufactured by **Carrier (Microchannel Condenser Coils)**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Rotary-Screw Water Chillers Air-Cooled, manufactured by **Carrier** as shown and scheduled on the drawings and as specified. Alternate chiller price shall include (5) five-year parts, labor, refrigerant, etc. extended warranty (re: 1.11 Warranty) and (5) five-year preventative maintenance contract (re: 1.12 Preventative Maintenance Service) as specified; there are no chillers included in the base bid.

J. Alternate Number 4c: 23 64 27 – Rotary-Screw Water Chillers Air-Cooled manufactured by **Trane (Microchannel Condenser Coils)**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Rotary-Screw Water Chillers Air-Cooled, manufactured by **Trane** as shown and scheduled on the drawings and as specified. Alternate chiller price shall include (5) five-year parts, labor, refrigerant, etc. extended warranty (re: 1.11 Warranty) and (5) five-year preventative maintenance contract (re: 1.12 Preventative Maintenance Service) as specified; there are no chillers included in the base bid.

K. Alternate Number 4d: 23 64 27 – Rotary-Screw Water Chillers Air-Cooled manufactured by **JCI (Microchannel Condenser Coils)**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Rotary-Screw Water Chillers Air-Cooled, manufactured by **JCI** as shown and scheduled on the drawings and as specified. Alternate chiller price shall include (5) five-year parts, labor, refrigerant, etc. extended warranty (re: 1.11 Warranty) and (5) five-year preventative maintenance contract (re: 1.12 Preventative Maintenance Service) as specified; there are no chillers included in the base bid.

L. Alternate Number 5a: 23 73 13 – Modular Indoor Central-Station Air-Handling Units and 23 63 13 Air-Cooled Refrigerant Condensers all manufactured by **Carrier**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Modular Indoor Central-Station Air-Handling Units and Air-Cooled Refrigerant Condensers manufactured by **Carrier** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

M. Alternate Number 5b: 23 73 13 – Modular Indoor Central-Station Air-Handling Units and 23 63 13 Air-Cooled Refrigerant Condensers all manufactured by **Trane**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Modular Indoor Central-Station Air-Handling Units and Air-Cooled Refrigerant Condensers manufactured by **Trane** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

N. Alternate Number 5c: 23 73 13 – Modular Indoor Central-Station Air-Handling Units and 23 63 13 Air-Cooled Refrigerant Condensers all manufactured by **Daikin**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Modular Indoor Central-Station Air-Handling Units and Air-Cooled Refrigerant Condensers manufactured by **Daikin** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

O. Alternate Number 5d: 23 73 13 – Modular Indoor Central-Station Air-Handling Units and 23 63 13 Air-Cooled Refrigerant Condensers all manufactured by **JCI**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Modular Indoor Central-Station Air-Handling Units and Air-Cooled Refrigerant Condensers manufactured by **JCI** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

P. Alternate Number 5e: 23 73 13 – Modular Indoor Central-Station Air-Handling Units and 23 63 13 Air-Cooled Refrigerant Condensers all manufactured by **Temtrol and Aaon**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Modular Indoor Central-Station Air-Handling Units and Air-Cooled Refrigerant Condensers manufactured by **Temtrol and Aaon** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

Q. Alternate Number 6a: 23 82 19.13 – Fan Coil Units manufactured by **Carrier**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Fan Coil Units, manufactured by **Carrier** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

R. Alternate Number 6b: 23 82 19.13 – Fan Coil Units manufactured by **Trane**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Fan Coil Units, manufactured by **Trane** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

S. Alternate Number 6c: 23 82 19.13 – Fan Coil Units manufactured by **JCI**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Fan Coil Units, manufactured by **JCI** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

T. Alternate Number 6d: 23 82 19.13 – Fan Coil Units manufactured by **Aaon**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Fan Coil Units, manufactured by **Aaon** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

U. Alternate Number 6e: 23 82 19.13 – Fan Coil Units manufactured by **Enviro-tec**
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish Fan Coil Units, manufactured by **Enviro-tec** as shown and scheduled on the drawings and as specified; there are no air handling units included in the base bid.

V. Alternate Number 7: 26 50 00 – Light Fixture Package
   1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish light fixtures as shown and scheduled on the drawings and as specified. The alternate will be broken down with 2 options which correlate to the light fixture schedule shown on the proposal documents. This alternate pricing shall include any batteries, drivers, generator transfer devices, fixture accessories, exit signs, parking poles/heads, wall packs, decorative supports or mountings as well as any wiring required to connect light fixture to remote battery or driver. Alternate pricing shall also include any attic stock of fixtures or drivers listed in the project. This alternate pricing shall not include the sports field lighting.

a. Alternate No. 7A: Light Fixture Package from CW Lighting.
b. Alternate No. 7B: Light Fixture Package from Lesco.

W. Alternate Number 8: 26 09 43 – Digital Lighting Controls

1. This Alternate shall establish the amount to be added to the Base Proposal for the Contractor to furnish a non-networked digital lighting control system as detailed on the drawings and as specified. The alternate will be broken down with 2 options which correlate to the acceptable products associated with this project. This alternate pricing shall include any wall switches, power packs, occupancy sensors, daylight harvesting sensors, handheld devices, relays, wiring and any accessories associated with a complete lighting control system. Alternate pricing shall also include any attic stock listed in the project.

   a. Alternate 8A: Digital Lighting Control solution from Wattstopper.
   b. Alternate 8B: Digital Lighting Control solution from Acuity.

END OF SECTION

SECTION 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Specified product compliance, and product quality assurance.

B. Specific administrative and procedural requirements for handling requests for substitutions made prior to award of Contract.

C. Requirements for product delivery, storage and handling.

1.3 RELATED REQUIREMENTS

A. Instructions to Offerors: Product options and procedures for submittal of requests for substitutions during the Proposal period.

1.4 DESCRIPTION OF REQUIREMENTS

A. Definitions: Definitions used in this Section are not intended to negate the meaning of other terms used in the Contract Documents, including such terms as “specialties”, “systems”, “structure”, “finishes”, “accessories”, “furnishings”, “special construction”, and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.
   1. Products: Shall mean items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor’s previously purchased stock. The term “product” as used herein includes the terms “material”, “equipment”, “system”, and other terms of similar intent.
      a. Named Products: Are those identified by the use of the manufacturer’s name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the Contract Documents.
      b. Specified Products: same as Named Products.

   2. Materials: Shall mean products that must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form units of work.
   3. Equipment: Is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

1.5 PRODUCT QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.
   1. When it is discovered that specific products are available only from sources that do not or cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Architect/Engineer for a determination of what product quantities are most important before proceeding. The Architect/Engineer will designate those qualities, such as visual, structural, durability, or compatibility, that are most important. When the Architect/Engineer’s determination has been made, select products from those sources that produce products that possess the most important qualities, to the fullest extent possible.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two (2) or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

C. Or Equal:
1. Where the phrase “or equal”, “or equivalent”, “or Architects approved equal”, or similar phrasing, occurs in the Proposal Documents, do not assume that materials, equipment, or methods of construction will be approved by the Architect unless the item has been specifically approved for this Work by the Architect.
2. The decision of the Architect shall be final.

D. Where a proposed substitution involves the work of more than one (1) contractor, each contractor involved shall cooperate and coordinate the work with each other contractor involved, so as to provide uniformity and consistency and to assure the compatibility of products.

E. Foreign Product Limitations: “Foreign products” as distinguished from “domestic products” are defined as products that are either manufactured substantially (50 percent or more of value) outside of the United States and its possessions, or produced or supplied by entities known to be substantially owned (more than 50 percent) by persons who are not citizens of nor living within the United States and its possessions.
1. Except under one (1) of the following conditions, select and provide domestic, not foreign, products for inclusion in the Work.
    a. There is no domestic product available that complies with the requirements of the Contract Documents.
    b. Available domestic products that comply with the requirements of the Contract Documents are available only at prices or other procurement terms that are substantially higher (25 percent or more) than for available foreign products that comply with the requirements of the Contract Documents.
    c. At the discretion of the Architect or Owner.

2. Final determination and acceptance will be the responsibility of the Architect.

F. Standards: Refer to Section 01 41 00, Regulatory Requirements for the applicability of industry standards to the products specified for the Project, and for the acronyms used in the text of the Specification Sections.

1.6 SUBSTITUTIONS OF PRODUCTS

A. The products described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an Addendum as a substitution prior to the submission of proposals.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least seven (7) days prior to the date for receipt of proposals. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

C. If the Architect approves any proposed substitution prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

D. The Architect and Owner reserve the right to disapprove the use of any manufacturer who in their judgment is unsuitable for use on the Project and that decision will be final

E. The following are not considered as substitutions:
   1. Revisions to the Contract Documents, when requested by the Owner, Architect, or any of their consultants are considered as “changes” not substitutions.
   2. Specified Contractor options on products and construction methods included in Contract Documents are choices made available to the Contractor and are not subject to the requirements specified in this Section for substitutions.
   3. Except as otherwise provided in the Contract Documents, the Contractor’s determination of and compliance with governing authorities do not constitute “substitutions” and do not constitute a basis for change orders.

F. The following may be considered as a reason for a request for substitution:
   1. The request is directly related to an “or approved equal” clause or similar language in the Contract Documents.
   2. The specified product or method of construction cannot be provided within the Contract Time in accordance with paragraph below concerning availability of specified items.
   3. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
   4. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other consideration of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Architect/Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.
   5. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
   6. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
   7. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

G. Availability of specified items:
   1. Verify prior to submittal of Proposal that all specified items will be available in time for installation during orderly and timely progress of the work.
   2. In the event specified items will not be so available, notify the Architect prior to receipt of Proposals. Submit Request for Substitutions in accordance with this section.
   3. The request will not be considered if the product or method cannot be provided as a result of the Contractor’s failure to pursue the work promptly or coordinate activities properly.
   4. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by the Owner.

H. A request constitutes a representation that Offeror:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product, except when inability to provide specified Warranty is reason for request for substitution as described above.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse the Owner and pay for all costs, including Architect/Engineer's redesign and evaluation costs resulting from the use of the proposed substitution, or for review or redesign services associated with re-approval by authorities having jurisdiction.

I. **No substitutions will be considered after the Award of Contract.**

1.7 SUBSTITUTION REQUEST SUBMITTAL

A. Requests for Substitutions: Submit three (3) copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related Specifications Section and Drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include, as appropriate, with each request, the following information:
   1. Product data, drawings and descriptions of products, fabrication and installation procedures.
   2. Samples, where applicable or requested.
   3. A detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect, where applicable.
   4. Coordination information, including a list of changes or modifications needed by other parts of the work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   5. A statement indicating the effect the substitution will have on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   6. Cost information, including a proposal of the net change, if any in the Contract Sum.
   7. Certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal-to or better than the work required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
   8. A statement indicating the Contractor will reimburse the Owner and pay for all costs, including Architect/Engineer's re-design and evaluation costs resulting from the use of the proposed substitution.

B. Work-Related Submittals: The Contractor's submittal of, and the Architect/Engineer's acceptance of, Shop Drawings, Product Data, or Samples which are related to work not complying with the Contract Documents, does not constitute an acceptance or valid request for a substitution, nor approval thereof.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control to prevent overcrowding of construction spaces or overloading of structure. In particular, coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.
   1. Deliver products to the site in the manufacturer's sealed containers or other packaging system, complete with labels intact, and instructions for handling, storage, unpacking, installing, cleaning and protecting.
   2. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.
   3. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
   4. Store products at the site or in a bonded and insured off-site storage facility or warehouse in a manner that will facilitate inspection and measurement of quantity or counting of units. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

5. Store heavy materials away from the project structure or in a manner that will not endanger the supporting construction.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one (1) of several different specifying methods, or in any combination of these methods. These methods include the following:
   1. Proprietary.
   2. Descriptive.
   3. Performance.
   4. Compliance with Reference Standards.

B. Compliance with codes, compliance with graphic details, allowances, and similar provisions of the Contract Documents also have a bearing on the selection process

C. Procedures for Selecting Products: The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects. Required procedures include, but are not limited to the following for the various indicated methods of specifying:
   1. Proprietary and Semi-Proprietary Specification Requirements:
      a. Single Product Name: Where only a single product or manufacturer is named, provide the product indicated, unless the specification indicates the possible consideration of other products. Advise the Architect/Engineer before proceeding, when it is discovered that the named product is not a reasonable or feasible solution.
      b. Two (2) or More Product Names: Where two (2) or more products or manufacturers are named, provide one (1) of the products named, at the Contractor's option. Exclude products that do not comply with specification requirements. Do not provide or offer to provide an unnamed product, unless the specification indicates the possible consideration of other products. Advise the Architect/Engineer before proceeding where none of the named products comply with specification requirements, or are not feasible for use. Where products or manufacturers are specified by name, accompanied by the term "or approved equal" or similar language, comply with this Section regarding "substitutions" to obtain approval from the Architect/Engineer for the use of an unnamed product.

   2. Non-Proprietary Specification Requirements: Where the specifications name products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to the use of these products only, the Contractor may, at his option, use any available product that complies with the Contract requirements.
   3. Descriptive Specification Requirements: Where the specifications describe a product or assembly generically, in detail, listing the exact characteristics required, but without use of a brand name, provide products or assemblies that provide the characteristics indicated and otherwise comply with Contract requirements.
   4. Performance Specification Requirements: Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated. The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.
   5. Compliance with Standards, Codes, and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of

selecting a product that complies with specification requirements, including standards, codes, and regulations.

6. Visual Matching: Where matching an established sample is required, the final judgement of whether a product proposed by the Contractor matches the sample satisfactorily will be determined by the Architect. Where there is no product available within the specified product category that matches the sample satisfactorily and also complies with other specified requirements, comply with the provisions of this Section regarding "substitutions" and other Contract Documents for "change orders" for the selection of a matching product in another product category, or for non-compliance with specified requirements.
7. Visual Selection: Except as otherwise indicated, where specified product requirements include the phrase "…as selected from the manufacturer's standard colors, patterns, textures…" or similar phrases, the Contractor has the option of selecting the product and manufacturer, provided the selection complies with other specified requirements. The Architect is subsequently responsible for selecting the color, pattern and texture from the product line selected by the Contractor.
8. Allowances: Refer to individual sections of the specifications and Section 01 21 00, Allowances for an indication of product selections that are controlled by established allowances, and for the procedures required for processing such selections.

D. Producer's Statement of Applicability: Where individual specification sections indicate products that require a "Statement of Applicability" from the manufacturer or other producer, submit a written-certified statement from the producer stating that the producer has reviewed the proposed application of the product on the project. This statement shall state that the producer agrees with or does not object to the Architect/Engineer's specification and the Contractor's selection of the product on the project is suitable and proper.

2.2 SUBSTITUTIONS

A. Condition: The Contractor's request for substitution will be received and considered when extensive revisions to Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request is timely, fully documented and properly submitted, and when one (1) or more of the above conditions are satisfied, all as judged and determined by the Architect/Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated.

B. Anchor each product securely in place, accurately located and aligned with other work.

C. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at time of acceptance.

D. Products and assemblies shall be installed complete, in-place, watertight and structurally sound.

3.2 INSTALLATION OF APPROVED SUBSTITUTIONS

A. Coordinate all approved substitutions with adjacent work.

B. Comply with the manufacturer's and/or supplier's instructions and recommendations for installation of the products in the applications indicated.

C. Provide all items required by manufacturer and/or supplier regarding installation, i.e. supplemental supports, anchors, fasteners, painting, etc. whether or not indicated or specified.

END OF SECTION 01 25 13

01 25 13.01 - REQUEST FOR SUBSTITUTION

Contract Award Date: _____

To: _____

Substitution Requested By: _____

Project Name and Number: _____

We submit for consideration the following product in lieu of the specified item for the above project:

Drawing No.	Specification Section	Paragraph	Specified Item
_____	_____	_____	_____

Proposed Substitution: _____

Request is made during ____ bidding _____ construction period.

Submit in accordance with Section 01 33 00.

1. Technical data, cost, and time information relating to changes to Construction Documents required by proposed substitution.
2. Detailed comparison of proposed substitution and specified product including but not limited to warranty, significant variations, qualifications of manufacturers, and maintenance.
3. Complete technical data, detailed shop drawings, samples, installation procedures, warranty, and substantiating data marked to indicate equivalent quality and performance to that specified. Manufacturer sell sheets are not acceptable submittals.

Cause for Request: _____

Cost saving realized by Owner _____

Does substitution affect adjacent Work, Construction Documents, cost, schedule, quality, and related submittals?

Yes _____ No ____ On separate sheet, explain affects to the Work, documents, schedule, and submittals.

The Contractor is responsible for associated costs and additional time of the proposed substitution including costs incurred by the Architect for evaluation of substitution and changes to the documents. Describe costs for changes to design, including engineering and detailing costs caused by the requested substitution.

_____

_____

Warranty: Is the warranty for the requested substitution the same or different? Yes _____ No _____

Explain Differences: _____

Contractor Certification:

In making a request for substitution, the Contractor certifies that:

1. The proposed substitution has been thoroughly researched and evaluated and determined as equivalent or superior to specified product or material, will fit into space provided, and is compatible with adjacent materials.
2. It will provide the same or better warranty for the proposed substitution at no additional cost to the Owner.

3. Cost data is complete and includes related costs under the Contract. Claims for additional costs related to the proposed substitution that may subsequently become apparent are waived.
4. It will assume the responsibility for delays and costs caused by the proposed substitution, if approved, are accepted by the Contractor unless delays are and costs are specifically mentioned and approved in writing by the Owner and the Architect.
5. It will assume the liability for the performance of the substitution and its performance.
6. The installation of the proposed substitution is coordinated with the Work and with changes required for the Work.
7. It will reimburse the Owner and Architect for evaluation and redesign services associated with the substitution request and, when required, by approval by governing authorities.

____ Has the substituted manufacturer/product been installed on previous PBK projects?

If so, list project(s): (List projects within the last two years)

1. _____
   District:_____
   Contact: _____
2. _____
   District_____
   Contact: _____

Submitted by:

_____
Signature of Contractor Title

_____
Firm Telephone Date

Signature shall be by the individual authorized to legally bind the Contractor's to the above terms. Failure to provide legally binding signature will result in retraction of approval.

FOR USE BY ARCHITECT:

____ Accepted ____ Accepted as Noted
____ Not Accepted ____ Received Too Late

By: _____

Date: _____

Remarks: _____

FOR USE BY OWNER:

____ Accepted ____ Not Accepted

By: _____

By: _____

Remarks: _____

END OF SECTION 01 25 13.01

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling and processing Contract modifications.

B. Related Work:
   1. Section 01 25 13 – Product Substitution Procedures.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 *Architect's Supplemental Instructions*.

1.4 PROPOSAL REQUESTS

A. Owner Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop Work in progress or to execute the proposed change.
   2. After receipt of Proposal Request, submit quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include statement outlining reasons for the change and the effect of the change on the Work. Provide complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Section 01 25 00 if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use AIA Document G709.

C. Contractor has ten (10) business days to submit pricing or submit resubmittal pricing to the Architect after issuance of a CPR or Change Proposal.

D. Regardless of initiated change request pricing, a fully developed and completed change pricing to be submitted.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: When an allowance is specified, refer to Section 01 21 00 for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
1. Allowance Adjustment: To adjust allowance amounts, base each Change Proposal Request (CPR) on the difference between purchase amount and the allowance, multiplied by final measurement of Work in place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   a. Include installation costs in purchase amount only where indicated as part of the allowance.
   b. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   c. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit cost allowances.
   d. Owner reserves the right to establish the quantity of Work in place by independent quantity survey, measure, or count.

2. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 7 days of receipt of the Change Order authorizing work to proceed. Owner will reject claims submitted later than 7 days after authorization.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will execute a Change Order also requiring signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work and designates the method to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of Work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

B. Pencil Copy: A preliminary review copy of the application for payment for review by Architect and Owner prior to submission of final copy.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Updated Submittal schedule.
      c. Items required to be indicated as separate activities in updated Contractor's construction schedule.

   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment. Contractor's standard form or electronic media printout will be considered but must be approved by the Owner.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.

   2. Arrange schedule of values consistent with format of AIA Document G703.

   3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.

      f. Change Orders (numbers) that affect value.

g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
   1) Labor.
   2) Materials.
   3) Equipment rentals.
   4) General Conditions.
      a. Supervisor.
      b. Submittals.
      c. Close-out.
      d. Field Engineering.
      e. Daily Clean-up.
      f. Final Clean-up.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on site and items stored off site. Include evidence of insurance.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line item value of unit cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual Work in place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Submit preliminary (pencil) copy of proposed values to Architect or Architects field representative and Owner for review by 20th date of the month. Allow 48 hours for comments.

B. Once preliminary (pencil) approved, submit electronic copy of notarized originals of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702 or other similar form approved by the Owner.

C. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

D. Submit updated construction or recovery schedule with each Application for Payment.

E. Payment Period: Submit at intervals stipulated in the Agreement in accordance with Document 00 73 00, Supplementary Conditions of the Contract.

F. Only materials stored on the project site shall be paid for unless the materials are stored in a bonded warehouse.

G. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Items which may be requested by the Architect or Owner to substantiate costs include, but are not limited to the following:
   1. Current Record Documents as specified in Section 01 77 00, Closeout Procedures maintained.
   2. Labor time sheets, purchase orders, or similar documentation.

3. Affidavits attesting to off-site stored products.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 29 00

SECTION 01 29 73 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. Work Included: Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein and in other provisions of the Contract Documents.

B. Coordinate requirements of this Section with the requirements of the General and Supplementary Conditions of the Contract concerning Schedule of Values.

1.3 QUALITY ASSURANCE

A. Use required means to assure arithmetical accuracy of the sums described.

B. When so required by the Owner, provide copies of the subcontracts or other data acceptable to the Owner, substantiating the sums described.

1.4 SUBMITTALS

A. Prior to the first Application for Payment, submit a proposed schedule of values to the Owner, as outlined below:
   1. Meet with the Owner and determine additional data, if any, required to be submitted.
   2. Secure the Owner's approval of the schedule of values prior to submitting first Application for Payment.

1.5 SCHEDULE OF VALUES

A. The Schedule of Values shall be broken down into item costs for each specification section as a minimum. After review by the Owner, the Schedule of Values shall be broken down into further items as required. (See following list and refer to the enclosed sample.). In addition, total each Specification Division separately.

B. Schedule of Values - Items in addition to Specification Sections.
   1. Mobilization
   2. Clean Up
   3. Building Permit
   4. Bonds, Insurance
   5. Misc. Mechanical Accessories
   6. Demolition
   7. Rough-In Labor - (Electrical)
   8. Rough-In Material - (Electrical)
   9. Finish Labor - (Electrical)
   10. Finish Material - (Electrical)
   11. Allowances (listed separately)
   12. Record drawings and close-out documents
   13. Submittals listed separately per mechanical, electrical and plumbing
   14. Roof warranty as a line item
   15. Donated items individually itemized at $0.00 (zero dollars).

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

A. Refer to following sample.

END OF SECTION 01 29 73

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Div. 1 - General Reqs.								
	Site Work General Conditions								
	Supervision								
	Mobilization								
	Bonds & Insurance								
	Permits								
	Contractor's Fee								
	Close-Out Documents								
	Div. 1 - Total								
	Div. 2 - Existing Conditions								
	Demolition (As applicable)								
	Erosion Control								
	Div. 2 - Total								
	Div. 3 - Concrete								
	Drill Piers								
	Caps & Beams								
	Slab on Grade								
	Cooling Tower Basin								
	Misc Bldg Conc								
	Floor Sealer								
	Rebar Matl								
	Rebar Labor								
	Lt.Wt.Insul Fill - Materials								
	Lt.Wt.Insul Fill - Labor								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 3 - Total								
	Div 4 - Masonry								
	Brickwork - Labor								
	Brickwork - Matls								
	Concrete Masonry - Labor								
	Concrete Masonry - Materials								
	Str. Glazed Tile-Labor								
	Str. Glazed Tile-Materials								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 4 - Total								
	Div 5 - Metals								
	Structural Steel - Labor								
	Structural Steel - Materials								
	Alternating Stairs								
	Misc. Steel - Materials								
	Steel Joists - Materials								
	Lt. Gauge Steel Framing-Labor								
	Lt. Gauge Steel Framing-Matls								
	Metal Decking - Labor								
	Expansion Joint Covers								
	Metal Decking - Matls								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Detailing								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 5 - Total								
	Div. 6 - Wood & Plastics								
	Rough Carpentry - Labor								
	Rough Carpentry - Materials								
	Millwork - Labor								
	Millwork - Materials								
	Submittals/Close-Out Documents								
	Div. 6 - Total								
	Div. 7 - Thermal and Moisture Protection								
	Waterpfng / Dampprfng-Matls								
	Waterpfng / Dampprfng-Labor								
	Building Insulation - Labor								
	Building Insulation - Materials								
	Fireproofing - Labor								
	Fireproofing - Materials								
	Metal Roof - Labor								
	Metal Roof - Materials								
	Metal Roof Guarantee								
	Built-up Roofing-Labor								
	Built-up Roofing-Materials								
	Built-up Roofing Guarantee								
	Roof Accessories								
	Building Sheet Metal - Labor								
	Building Sheet Metal - Matls								
	Bldg. Sheet Metal Guarantee								
	Roof Curbs								
	Roof Hatches								
	Sealants								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 7 - Total								
	Div. 8 - Doors and Frames								
	Finish Carpentry/Door - Labor								
	Finish Hardware - Matls								
	Thresholds & Seals - Matls+B66								
	Hollow Metal Doors & Frames - Matls								
	Plastic Faced Doors-Matls								
	Overhead Doors & Grilles-Labor								
	Overhead Doors & Grilles - Matls								
	Alum. Entrances & Store-fronts - Labor								
	Alum. Entrances & Store-								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	fronts - Matls								
	Alum. Windows - Labor								
	Alum Windows - Matls								
	Glass & Glazing-Labor								
	Glass & Glazing-Matls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 8 - Total								
	Div. 9 - Finishes								
	Lath & Plaster-Labor								
	Lath & Plaster-Matls								
	Gypsum Wallboard								
	Systems - Labor								
	Gypsum Wallboard								
	Systems - Matls								
	Ceramic Tile - Labor								
	Ceramic Tile - Matls								
	Quarry Tile - Labor								
	Quarry Tile - Matls								
	Terrazzo-Labor								
	Terrazzo-Matls								
	Acoustic Clg. - Labor								
	Acoustic Clg. - Matls								
	Acoustic Wall Panels								
	Resilient Flooring - Labor								
	Resilient Flooring - Matls								
	Carpet - Labor								
	Carpet - Matls								
	Athletic Flooring - Materials								
	Athletic Flooring - Labor								
	Floor Sealer								
	Painting - Labor								
	Painting - Mtls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 9 - Total								
	Div. 10 - Specialties								
	Visual Display Boards &								
	Tackboards - Materials								
	Visual Display Boards &								
	Tackboards - Labor								
	Toilet Partitions - Labor								
	Toilet Partitions - Matls								
	Louvers								
	Aluminum Flag Pole								
	Graphics								
	Lockers								
	Cubicle Curtains & Track								
	Fire Extinguisher Cabinets								
	Demountable Partitions-Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Demountable Partitions-Matls								
	Shelving								
	Toilet Room Accessories-Matls								
	Toilet Room Accessories-Lbr								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 10 - Total								
	Div. 11 - Equipment								
	Stage Curtains								
	Misc. Appliances								
	Food Service Eqpt-Labor								
	Food Service Eqpt-Matls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 11 - Total								
	Div. 12 - Furnishings								
	Horizontal Blinds								
	Projection Screens								
	Casework - Labor								
	Casework - Matls								
	Science Casework - Labor								
	Science Casework - Matls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 12 - Total								
	Div. 13 - Specialties								
	Stage Curtains and Draperies								
	Music Instrument Storage								
	Bleachers								
	Press Box								
	Pre-eng. Metal Bldg.								
	Stadium Seating								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 13 - Total								
	Div. 14 - Conveying Systems								
	Platform Lifts								
	Elevators								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 14 - Total								
	Div. 21, 22 - Plumbing								
	Shop Drawings								
	As-Builts/Close-Out/ O&M Manuals								
	Sanitary Underground -								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Labor								
	Sanitary Underground - Matls								
	Storm Underground - Labor								
	Storm Underground - Matls								
	Domestic Water - Labor								
	Domestic Water - Matls								
	Plumbing Insulation - Matls								
	Plumbing Insulation - Labor								
	Gas Piping - Matls								
	Gas Piping - Labor								
	Grease Trap								
	Plumbing Fixtures - Matls								
	Plumbing Fixtures - Labor								
	Coordination Drawings								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 21, 22 Plumbing - Total								
	Div. 23 - Mechanical								
	Shop Drawings								
	As-Builts/Close-Out/ O&M Manuals								
	Chillers - Matls								
	Chillers - Labor								
	Cooling Towers - Matls								
	Cooling Towers - Labor								
	Boilers - Matls								
	Boilers - Labor								
	AHU's - Matls								
	AHU's - Labor								
	Fans - Matls								
	Fans - Labor								
	Grilles - Matls								
	Grilles - Labor								
	Ductwork - Matls								
	Ductwork - Labor								
	Pumps - Mtls								
	Pumps - Labor								
	Water Treatment - Labor								
	Water Treatment - Matls								
	Isolation - Labor								
	Isolation - Matls								
	Pipe Flex - Matls								
	Pipe Flex - Labor								
	Connections								
	Sheet Metal - Matls								
	Sheet Metal - Labor								
	Duct Insulation - Matls								
	Duct Insulation - Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Pipe Insulation - Matls								
	Pipe Insulation - Labor								
	VAV Boxes - Materials								
	VAV Boxes - Labor								
	Refrigerant Monitor - Matls								
	Refrigerant Monitor - Labor								
	Unit Heaters - Materials								
	Unit Heaters - Labor								
	Startup								
	Controls - Matls								
	Control - Labor								
	Engineer / Submittals								
	Modules / End Devices								
	Low Voltage Wiring								
	Startup								
	Close-Out Documents								
	Fire Sprinkler								
	Engineer / Submittals								
	Piping - Materials								
	Piping - Labor								
	Equipment - Materials								
	Equipment - Labor								
	Trimout - Materials								
	Trimout - Labor								
	Pipe, Valves, Fittings - Labor								
	Pipe, Valves, Fittings - Matls								
	Misc. - Matls								
	Insulation - Matls								
	Insulation - Labor								
	Sanitary Above Slab-Labor								
	Sanitary Above Slab-Matls								
	Storm Above Slab - Labor								
	Storm Above Slab - Matls								
	Gas - Labor								
	Gas - Matls								
	Fixtures - Labor								
	Fixtures - Matls								
	Permits								
	Coordination Drawings								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 23 Mechanical - Total								
	Div. 26 - Electrical								
	Mobilization+B220								
	Shop Drawings								
	As-Builts/Close-Out/ O&M Manuals								
	Underground								
	Conduit - Labor								
	Conduit - Matl								
	Wire - Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Wire - Matls								
	Feeder Wire - Labor								
	Feeder Wire - Matls								
	Switches/Recpt.								
	Switchgear - Labor								
	Switchgear - Matls								
	Temporary - Materials								
	Temporary - Labor								
	Gas Generator - Materials								
	Gas Generator - Labor								
	Fixtures - Labor								
	Fixtures - Matls								
	Communications - Labor								
	Communications - Matls								
	Fire Alarm - Labor								
	Fire Alarm - Matls								
	Security - Labor								
	Security - Matls								
	Low Voltage Ltng Sys-Matls								
	Low Voltage Ltng Sys-Labor								
	Voice System - Materials								
	Voice System - Labor								
	Video System - Materials								
	Video System - Labor								
	Data System - Materials								
	Data System - Labor								
	Master Clock - Materials								
	Master Clock - Labor+B277								
	Coordination Drawings								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 26 - Total								
	Divs. 31, 32 and 33 - Earthwork, Exterior Improvements and Utilities								
	Site Clearing & Grubbing								
	Building Pad - Materials								
	Building Pad - Labor								
	Paving Subgrade								
	Signage / Striping								
	Bike Racks								
	Landscaping - Materials								
	Landscaping - Labor								
	Hydro Mulch - Materials								
	Hydro Mulch - Labor								
	Irrigation - Materials								
	Irrigation - Labor								
	Earthwork								
	Finish Grading								
	Stabilization - Materials								
	Stabilization - Labor								
	Site Drainage - Materials								
	Site Drainage - Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Chain Link Fence-Materials								
	Chain Link Fence-Labor								
	Paving - Labor								
	Paving - Materials								
	Sidewalks								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 31, 32 and 33 - Total								
	General Conditions								
	Mobilization								
	Temp. Facilities								
	Final Cleaning								
	Record Documents/Close-out/ O&M Manuals								
	Supervision								
	Permits								
	Bonds								
	Insurance								
	Allowances								
	Alternates (list)								
	Change Orders								
	A. PR#								
	B. PR#								
	C. PR#								

END OF SECTION

SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Pre-install meetings.

B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific Contractor.

C. Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. Requests for Information (RFI's) will not be allowed from the Contractor. The Contractor shall arrange the necessary meeting in the field with appropriate Architect's field representative(s) to obtain clarification as needed on items that may need interpretation.

1.3 SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each Contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of the Work. Each

Contractor shall coordinate its operations with operations, included in different Sections, which depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other Contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate Contractors if coordination of the Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Coordinating inspections and other jurisdictional requirements.
   10. Coordinate OFCI equipment.
   11. Action items and issue logs.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to the Specifications Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade specific information to the coordination drawings by multiple Contractors in sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      f. Indicate required installation sequences.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures, ductwork, piping, and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   e. Floor boxes.

8. Fire Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, sprinkler heads, and inspector test locations.

9. IDF/MDF Rooms: Communications and low voltage (security, data, phone, etc.) audio

10. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

11. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.

2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in Revit.
    c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Architect to prepare the meeting agenda and distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
4. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
5. Issue logs: Documentation element of software project management and contains a list of ongoing and closed issues of the project.

B. Kick-off & Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.
1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that affect progress.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

C. Preinstallation Conferences: Conduct a preinstallation trade conference at site before each construction activity that requires coordination with other construction trades.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Engineer of Record of scheduled meeting dates.
2. Agenda: Contractor to review progress of other construction activities and preparations for the particular activity under consideration.
3. Contractor to record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Contractor to distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
6. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Substantial Completion.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each Contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
    b. Six (6) week look-ahead schedules.

5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

F. Coordination Meetings: Conduct coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each Contractor present.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
4. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 31 00

SECTION 01 31 19 - PROJECT MEETINGS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE

A. The Architect's:
   1. Scheduling of each meeting (pre-construction meeting, periodic project meetings, and specialty called meetings throughout the progress of the Work).
   2. Preparation of agenda for meetings.
   3. Presiding at minutes, including all significant proceedings and decisions.
   4. Recording, reproducing, and distributing copies of meeting minutes within two (2) working days, excluding weekends and holidays, after each meeting to:
      a. All participants in the meeting.
      b. All parties affected by decisions made at the meeting.
   5. Providing status report of allowance funds.

B. The Contractor's:
   1. Making physical arrangement for meetings.
   2. Participation in all meetings and conferences.
   3. Scheduling attendance of Job Superintendent, Project Coordinator, and other parties affecting or affected by decisions made at meetings and conferences as their interests require.
   4. Scheduling Pre-installation conferences.
   5. Scheduling Pre-Closeout Meeting
   6. Providing updated schedules.
   7. Providing status reports/logs of CPRs, MCs, and shop drawings/submittals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

A. Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction meeting with Contractor, Architect, and Owner. This meeting must occur prior to commencement of any construction.

B. Architect will:
   1. Administer pre-construction conference for the establishment of communication methods, procedures and Owner requirements.
   2. Administer site mobilization conference for clarification of Owner and Contractor.

C. Location: At Project site as designated by the Architect.

D. Attendance:
   1. Contractor or Contractor's Representatives
   2. Job Superintendent
   3. Project Coordinator (Manager)
   4. Owner or Owner's Representative

5. Major subcontractors
6. Major suppliers
7. Architect's Representative
8. Others as appropriate

E. Meeting Agenda, may include, but is not limited to:
1. Discussion on major subcontracts and suppliers and projected construction schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities. Discussion of long lead time items.
4. Project coordination and designation of responsible personnel.
5. Procedures and processing of field decisions, proposal requests, submittals, minor changes, change orders and applications for payment.
6. Method of distribution of Contract Documents.
7. Procedures for maintaining Record Documents.
8. Use of premises, office work and storage areas, on-site parking, and Owner's requirements.
9. Construction facilities and temporary utilities.
10. Housekeeping procedures.

3.2 PROGRESS MEETINGS

A. Architect will:
1. Schedule project meetings throughout progress of the work at weekly intervals, and specially called meetings.
2. Set agenda and administer said meetings.
3. Preside at meetings.
4. Record meeting minutes, including all significant proceedings and decisions.
5. Reproduce and distribute copies of meeting minutes within two (2) working days, excluding weekends and holidays, after each meeting to:
a. All participants in the meeting.
b. All parties affected by decisions made at the meeting.

B. Architect shall:
1. Make physical arrangements for meetings.

C. Attendance:
1. Contractor or Contractor's Representative
2. Job Superintendent
3. Project Coordinator (Manager)
4. Owner or Owner's Representative
5. Major subcontractors
6. Major suppliers
7. Architect's Field Representative
8. Consultants as needed
9. Others as appropriate

D. Meeting Agenda, may include, but is not limited to:
1. Review and approval of minutes of previous meeting.
2. Review of Work progress since previous meeting.
3. Field observations, problems, and conflicts.
4. Review of off-site fabrication and delivery schedules.
5. Corrective measures and procedures to regain projected schedule.
6. Revisions to Construction Schedule.
7. Plan progress and schedule during succeeding work period.
8. Coordination of schedules.
9. Review submittal schedules and expedite as required.
10. Maintenance of quality standards.

11. Allowance balances.
12. Review of proposed changes and substitutions for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the Project.
13. Status of Allowance Expenditure Authorizations (AEAs).
14. Status of Change Proposal Requests (CPRs).
15. Status of Minor Changes (MCs).
16. Status of submittals, review of submittal log.
17. Other items and critical issues affecting Work.

3.3 PRE-INSTALLATION CONFERENCES

A. In accordance with the requirements of Section 01 11 00, Notification of Architect Requirements, the Contractor will convene pre-installation conferences when required by individual specification Sections or as required by the Architect, prior to the Contractor commencing Work of the Section.

B. Attendance, optional:
1. General Contractor or Contractor's Representative
2. Project Coordinator (Manager)
3. Owner or Owner's Representative
4. Architect's Project Manager (Project Executive)

C. Attendance, required:
1. Project Superintendent
2. Architect's Field Representative
3. Sub-contractor's Project Manager
4. Sub-contractor's Foreman
5. Engineer's Representative, as needed.
6. Manufacturer's Representative, as needed.
7. Governing Agency Official, as required
8. Inspection Agency Representative, as required.
9. Others affecting or affected by Work.

D. Meeting Agenda, may include, but is not limited to:
1. Review of conditions of installation.
2. Preparation and installation procedures.
3. Coordination with related work
4. Review of the contract document requirements.
5. Review of code enforcement or testing requirements.
6. Questions related to work required.

3.4 PRE-CLOSEOUT MEETING

A. In accordance with the requirements of Section 01 77 00, Closeout Procedures, the Contractor will convene a pre-closeout meeting when he considers the Work or designated portion of the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the work for its intended use.

B. Attendance, required:
1. Owner or Owner's Representative
2. Project Coordinator (Manager)
3. General Contractor or Contractor's Representative
4. Project Superintendent
5. Architect's Project Manager (Project Executive)
6. Architect's Field Representative
7. Engineer's Representative, as needed.

C. Meeting Agenda, may include, but is not limited to:
   1. Review of the contract document requirements for Substantial Completion and Project Closeout
   2. Review of Work which remains to be completed or corrected.
   3. Closeout Document review schedule and log
   4. Review of closeout procedures including, but not limited to Record Drawings, Warrantees, Operation and Maintenance Manuals, and Owner Demonstrations and Start-up.
   5. Review of code enforcement or testing requirements.
   6. Questions related to work required.

3.5 PRE-INSTALLATION CONFERENCES

A. Contractor shall convene pre-installation conferences for all applicable scopes of work listed below. All applicable pre-installation conference dates shall be included in the project progress schedules submitted with the monthly application for payment.

Division 1 - General Requirements
Survey
Geotechnical Boring Logs
SUE -Subsurface Utility Engineering
Site Laydown and Utilization
Validation of AHJ (Municipality, MUD,SUD)
Validation of long lead items
Schedule Validation (Campus Event Coordination)

Division 2 - Site Work
SWPPP
Underground Storm
Electrical Primary and Data Communications Ductbanks
Sanitary Sewer System/Water
Irrigation and Landscaping
Natural Gas

Division 3 - Concrete
Foundation Systems
Paving and Flatwork
Elevated Concrete

Division 4 - Masonry
Structural Masonry
Veneer Masonry
Partition Masonry

Division 5 - Metals
Structural Steel
Ornamental Metal
Division 5 and 8 Coordination

Division 6 - Woods, Plastics, Composites
Blocking
Millwork

Division 7 - Thermal & Moisture Waterproofing Protection
Roofing
Fireproofing

Insulation

Division 8 - Openings
Windows
Doors and Hardware

Division 9 - Finishes
Flooring Systems
Wall Finishing Systems
Ceiling Systems
MEP Coordination for Division 9 Items

Division 10 - Specialties
Supergraphics Validation
MEP Coordination for Division 10 Items

Division 11 - Equipment
Coordination with Divisions 3, 15 and 16
Playground
ADA Equipment

Division 12 Furnishings/Specialties
Furnishings Sanitary Fixtures (Owner Provided)
Appliances
Acoustical Systems

Division 13 - Special Construction
Pre-Engineered Metal Buildings
Fire Sprinkler Systems

Division 14 - Elevators

Division 15 - Plumbing & Mechanical Commissioning
Plumbing
Kick off meeting to include TAB, GC and Mech sub
HVAC/Controls

Division 16 - Electrical
Power Distribution
Lighting Systems/Controls
Fire Alarm
PA System
Stage AV
Security Systems/Access Control

END OF SECTION 01 31 19

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's construction schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Special reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Resource Loading: The allocation of manpower and equipment necessary for completion of an activity as scheduled.

G. Recovery Schedule: Submittal of a revised critical path method (CPM) schedule and a written plan.

H. Look-ahead Schedule: Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update.

I. Milestones: Measurable and observable and serve as progress markers (flags) but, by definition, are independent of time (have zero durations) therefore no Work or consumption of resources is associated with them.

1.4 SUBMITTALS

A. Submittal Format: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.

B. Startup Diagram: Of size necessary to display entire network for entire construction period. Show logic relationship ties for all activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at monthly intervals.

G. Material Location Reports: Submit at monthly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at site. Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss constraints, including phasing, Work stages, area separations, interim milestones, and partial Owner occupancy.
   4. Review delivery dates for Owner furnished products.
   5. Review schedule for Work of Owner's separate contracts, if any.
   6. Review submittal requirements and procedures.
   7. Review time required for review of submittals and resubmittals.
   8. Review requirements for tests and inspections by independent testing and inspecting agencies.
   9. Review time required for Project closeout and Owner startup procedures.
   10. Review and finalize list of construction activities to be included in schedule.
   11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Time is of the essence to the Owner. Commence Work immediately upon issuance of the Notice to Proceed. There is a critical need for the Work to be substantially complete within the time frame identified in the Agreement.

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion and date of final completion.
1. Contract completion date shall not be changed by submission of schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each separate area or story as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities in terms of number of days anticipated.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include number of days anticipated for startup and testing.
5. Substantial Completion: Indicate completion of all conditions as in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include a maximum of 30 days for completion of punch list items and final completion.
7. Inspections required by Authorities Having Jurisdiction (AHJ).

D. Constraints: Include constraints and Work restrictions indicated in the Contract Documents and show how the sequence of the Work is affected.
1. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   f. Provisions for future construction.
   g. Seasonal variations.
   h. Environmental control.
   i. Rain days as indicated in Specification Section 01 10 00 Summary.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   a. Submittals.
   b. Mockups.
   c. Fabrication.
   d. Installation.
   e. Tests and inspections.
   f. Adjusting.
   g. Curing.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

F. Six (6) week, lookahead schedule: Prepare schedule indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.
6. Inspections by Authorities Having Jurisdiction (AHJ).
7. Trade pre-installation conference.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

I. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

J. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.2 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording information concerning events at the site and submit each month to Architect:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Rental equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of Authorities Having Jurisdiction (AHJ).
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or

items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report and contact Architect Field Representative. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents to Architect Field Representative.

D. Special Reports: Submit special reports directly to Owner within 24 hours of an occurrence. Distribute copies of report to parties affected by the occurrence.

1. Reporting Unusual Events: When an event of an unusual and significant nature occurs at site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner & Architect in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule with a pencil copy of pay application.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and interested parties identified by Contractor with a need to know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Submittals: Written and graphic information and physical samples that require Architect's responsive action or are for information and do not require the architect’s action.

B. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

C. Portable Document Format (PDF): An open standard file format used for representing documents in a device independent and display resolution independent fixed layout document format.

1.4 SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
   1. Upon request, Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
      a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
      b. Digital Drawing Software Program: The Contract Drawings are available in Revit.
      c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
      d. The following digital data files will by furnished for each appropriate discipline:

1) Floor plans.
2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow ten (10) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process in same manner as initial submittal.
3. Resubmittal Review: Allow ten (10) days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow ten (10) days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
3. Transmittal Form for Electronic Submittals: Use software generated form from electronic project management software acceptable to Owner**,** containing the following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.
   g. Names of subcontractor, manufacturer, and supplier.
   h. Category and type of submittal.
   i. Submittal purpose and description.
   j. Specification Section number and title.
   k. Specification paragraph number or drawing designation and generic name for each of multiple items.
   l. Drawing number and detail references, as appropriate.
   m. Location(s) where product is to be installed, as appropriate.

n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

4. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit electronic submittals via email as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

   2. Certificates and Certifications Submittals: Provide statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in PDF electronic file.

C. Shop Drawings: Prepare Project specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.

   2. Sheet Size: Except for templates, patterns, and similar full size drawings, submit Shop Drawings on sheet size indicated in specification section.

   3. Submit Shop Drawings in PDF electronic file.
   4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
      a. Prepare Shop Drawings in same digital data software program, version, and operating system as the original Drawings.
      b. Refer to Section 01 31 00 for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
      e. Specification paragraph number and generic name of each item.

   3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples: Submit full size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Key Items Review Time: Submit samples to the Architect at least 30 days prior to the date the Contractor needs the reviewed submittals returned. The Contractor shall be prepared to submit color samples on any key items in Division 09 finishes within 30 days of the award of Contract. Once samples of all key items are received, the Architect will finalize color selections.
   b. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Division 01.

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01.

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 73.

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 45 23.

J. Closeout Submittals required for Substantial Completion: Comply with requirements specified in Section 01 77 00.

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated design drawing and data files into Building Information Model established for Project.
   1. Prepare delegated design drawings in the same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

C. Incomplete submittals are not permitted, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents will be returned by the Architect without action.

END OF SECTION 01 33 00

Section 01 35 23.2

Special Owner Requirements - Badging Process

For Contractors, Sub-Contractors, Service Providers, & Vendors

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

Contact the Lamar CISD Bond Program Office for necessary submission information and procedures.

1.1 SECTION INCLUDES

A. The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in Owner's Board Policy CJA and the form included herein, as required by Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117, and shall comply with all requirements of such laws and policy.

B. The General Contractor shall provide a list of all employees, suppliers, etc., that will be on the job site for more than 1 hour per day. Lists must be forwarded to the Lamar CISD Bond Program Office 72 hours or earlier in advance of going to the site. List shall be submitted on the form template provide by the Lamar CISD Bond Program Office. Should a Contractor want to add names to their original list, they must be added on a separate list.

C. Only workers who have a completed and clear background check shall be eligible for a badge.

D. Mandatory photo identification badge with the workers name and name of the Construction Company shall be worn at all times on school district property during the construction of the project ***[required after Substantial Completion for new buildings].*** The badges shall be provided, funded and maintained by the General Contractor. The Owner reserves the right to reject the issuing of a badge to any contractor employee as deemed appropriate to protect the Owner's interest. The Owner reserves the right to dismiss any worker not wearing proper identification, from the project site.

E. Badges will include the General Contractor, Subcontractor or Sub-subcontractor name, expiration date of the project, and photo identification of the authorized person. The expiration date will typically be 6 months after the scheduled contract substantial completion date, but not longer than one year from date of issuance. Upon expiration, the contractor shall repeat the application process.

F. The Contractor shall contact the Bond Program Office with any questions during the process.

G. Badge color for contractors and subcontractors shall be ORANGE.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 Not Used

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
   4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Laboratory Mockups: Full size physical assemblies constructed at testing facility to verify performance characteristics.
   2. Integrated Exterior Mockups: Mockups of exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
   3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality Control Testing: Tests and inspections performed on site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations.
   1. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, *experienced* means having successfully completed a minimum of five years documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Shop Drawings: Submit plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting Work on the following systems:
   1. Seismic force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by Architect.
   2. Main wind force resisting system or wind resisting component listed in the wind force resisting system quality assurance plan prepared by Architect.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.

9. Unique characteristics of each quality control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

E. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.7 QUALITY ASSURANCE

A. Qualifications establish the minimum qualification levels required; refer to individual Specification Sections for additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated and sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated and with record of successful in service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling Work similar in material, design, and extent to that indicated for this Project, whose Work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Texas, experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products.

I. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

   2. Testing Agency Responsibilities: Submit certified written report of each test, inspection, and similar quality assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect a minimum of seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting Work, fabrication, or construction. Allow **seven** days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Mockup of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies shall be constructed. Mockup, if not specifically shown on the drawings, shall be minimum 8’x8’. Mockup shall include all major façade elements and at least one window minimum 2’x2’ in size. Prior to constructing mockup verify requirements with architect. Pre-installation conferences for trades involved in Integrated Exterior Mockup shall be held after mock up is completed.

M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

N. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300.

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner:

B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections.
   1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 40 00

SECTION 01 42 00 – OWNER'S REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for student and staff security and safety assurance during active construction on a Lamar CISD "Occupied Campus".

1.3 DEFINITIONS

A. Lamar CISD "4S" Initiative: Clear and precise "4S" branding recognizable to all age groups identifying areas of active construction on occupied campuses.

B. 4S Safety Plan: Contractor shall develop a site and floor plan defining all construction and operational items occurring on the "Occupied Campus". Refer to Item 1.4A below for detailed requirements.

C. Contractor: Refers to the General Contractor, Job Order Contractor (JOC), Cooperative Contractor or Construction Manager at Risk.

D. Construction Worker: Any worker working for the "Contractor" or under the "Contractor's" general conditions responsibilities.

E. Occupied Campus: A campus with any staff or students present at any time.

F. Badge: Clear and precise identification worn by all "Construction Workers" on site. Refer to the "Badging" 01 35 23 specification section for detailed requirements.

G. Secure Door: A door that is locked and latched and does not open when pulled.

H. Barricade: A physical and visual barrier that is clearly marked with signage stating a warning message and directions to an alternate route.

I. Fencing: a minimum of 6'-0" high chain-link secure fence with wind screens enclosing the active construction site with no gaps greater than 6" in width. Refer to "Temporary Facilities & Controls" 01 50 00 specification section for additional detail requirements.

J. Safe Passage: A passageway clear and free of any construction hazards or obstacles.

K. Inappropriate Contact: **ANY** physical or verbal contact between a "Construction Worker" and students, staff, or community members.

L. Zero Tolerance: One time occurrence resulting in removal from all Lamar CISD campuses permanently.

1.4 SUBMITTALS

A. 4S Safety Plans: Contractor shall submit site and floor plans indicating the following items:
1. Identify secure construction area.
2. Identify construction entry and exit points.
3. Identify contractor parking.
4. Identify bus drop-off and pick-up route and location.

5. Identify parent drop-off and pick-up route and location.
6. Identify overhead power lines.
7. Identify secure laydown areas.
8. Identify dumpster locations.
9. Identify port-a-can restroom locations.
10. Identify muster location.
11. Identify evacuation location (ambulance & helicopter).
12. Identify location of signage.
13. Identify egress pathways with “Safe Passage” to a point 50’-0” from any built structure.
14. Identify and modify emergency evacuation routes.

1.5 REPORTS AND DOCUMENTS

A. Observation Reports: A report of any form generated by any project member. A report concerning students, staff, safety, or security shall be addressed immediately once received.

B. 4S Observation Reports: Bond Program Office generated observation report that requires immediate resolution.

C. All verbally relayed observations to the “Contractor” concerning students, staff, safety, or security shall be addressed immediately once received.

1.6 REQUIREMENTS

A. Lamar CISD will have a “Zero Tolerance” policy for the following items:
1. “Construction Worker” without a “Badge”.
2. “Construction Worker” not ensuring that all doors are “Secure Doors”.
3. “Construction Worker” alters or removes “Barricades” during construction without an alternative “4S Safety Plan” in place.
4. “Construction Worker” alters or removes “Fencing” during construction without an alternative “4S Safety Plan” in place.
5. “Construction Worker” having “Inappropriate Contact” with any student, staff, or community member.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 IMPLEMENTATION, MAINTAINCE AND TRAINING

A. The “Contractor” shall be responsible for all management, materials and equipment required to implement the “4S Safety Plan”. The Owner will provide “4S” stickers and signage to be distributed and installed by the “Contractor”.

B. The “Contractor” shall provide all updates to the “4S Safety Plan” when scope or site conditions change. Changes to the “4S Safety Plan” shall be provided and reviewed at least **7 days prior** to the site conditions changing. The safety plan shall be posted in a visible location in the jobsite trailer.

C. The “Contractor” shall train all “Construction Workers” on the requirements listed within the Owner Requirements 01 42 00 section prior to performing any work on a Lamar CISD “Occupied Campus”.

END OF SECTION 01 42 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK REQUIREMENTS

A. General: This Section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include the obtaining of permits, licenses, inspections, releases, and similar statements, as well as payments, associated with regulations, codes, and standards.

B. “Regulations” is defined to include laws, statutes, ordinances, and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the Work regardless of whether they are lawfully imposed by governing authority or not.

C. Governing Regulations: Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations.

1.3 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized", "selected", "required", and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown", "noted", "scheduled", and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. “Testing Agencies”: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference. Individual Specification Sections indicate which codes and standards the Contractor must keep available at the project site for reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

D. Minimum Quantities or Quality Levels: In every instance the quantity or quality level shown or specified is intended to be the minimum for the Work to be provided or performed. Unless otherwise indicated, the actual Work may either comply exactly, within specified tolerances, with the minimum quantity or quality specified, or may exceed that minimum within reasonable limits. In complying with these requirements, the indicated numeric values are either minimum or maximum values, as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to the Architect/Engineer for decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction or other entity applicable to the context of the text provision.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the Agency.

C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.

1.6 SUBMITTALS

A. Permits, Licenses and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 42 00

SECTION 01 45 23 – STRUCTURAL TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. The testing laboratory shall make all inspections and perform all tests in accordance with the building code, local authorities, ASTM specifications and the Contract Documents.

B. The testing laboratory shall provide as a part of the project's close-out documents or as required by any regulatory authority, all appropriate signed and sealed Special Inspection Certificates whose purpose would be to provide consistency and direction for compliance with the referenced Building Code. These Special Inspection Certificates shall confirm that that all work requiring special inspection has been adequately performed, and the special inspections have been made by an individual or firm that is qualified to make special inspections per the referenced Building Code.

C. Materials and workmanship not meeting the required standards are to be removed and replaced. Replacement and subsequent testing shall be at the expense of the Contractor.

D. Testing, inspection, and certifications specified in other sections of these Specifications shall be paid by the Owner, unless otherwise indicated.

E. Inspection by the laboratory shall not relieve the Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

1.3 REFERENCED STANDARDS

A. The latest adopted edition of all standards referenced in this Section shall apply, unless noted otherwise.

B. ACI 311 – ACI Manual of Concrete Inspection

C. ACI 301 - Specification for Structural Concrete

D. In case of conflict between these Contract Documents and a referenced standard, the Contract Documents shall govern. In case of conflict between these Contract Documents and the Building Code, the more stringent shall govern.

1.4 QUALITY ASSURANCE

A. Testing Laboratory shall meet the requirements of ASTM E329 and ASTM E543.

B. Testing Laboratory shall be insured against errors and omissions by a professional liability insurance policy having a limit of liability not less than $500,000.

C. Testing Laboratory shall be under the direction of a Registered Engineer who is legally authorized to practice in the jurisdiction where Project is located and having at least five years experience in inspection and testing of construction materials.

D. Laboratory staff monitoring concrete work shall be ACI certified inspectors.

E. Laboratory staff performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, "Standard and Guide for Qualification and Certification of Welding Inspectors". The inspector may be supported by assistant inspectors who may perform specific inspection functions under the supervision of the inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). The work of the assistant inspectors shall be regularly monitored by the inspector, generally on a daily basis.

F. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.5 LABORATORY RESPONSIBILITIES

A. Attend preconstruction meetings and progress meetings as required to coordinate work with the Contractor and address quality control issues.

B. Test samples of design mixes submitted by Contractor.

C. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.

D. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.

E. Ascertain compliance of materials and mixes with requirements of Contract Documents.

F. Promptly notify Architect/Engineer and Contractor of observed irregularities or non conformance of Work or Materials.

G. Perform all inspections and tests in accordance with building code requirements for "Special Inspection" whether or not such inspections are specified in the Contract Documents.

H. Testing Laboratory shall write a letter at the completion of the project, signed, and sealed by a registered engineer in the state of the project, summarizing the inspections performed, the dates they were performed, and whether the observed construction complied with the Contract Documents.

1.6 LABORATORY REPORTS

A. After each inspection and test, promptly submit copies of laboratory reports to Architect, Engineer, Owner and to Contractor.

B. Include:

1. Date issued
2. Project title and number
3. Name of inspector
4. Date and time of sampling or inspection
5. Identification of product and specifications section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge the requirements of the Contract Documents.

B. Laboratory may not approve or accept any portion of the Work, except where such approval is specifically called for in these specifications.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the Work.

1.8 CONTRACTOR RESPONSIBILITIES

A. See technical sections of these specifications for specific requirements.

B. Deliver to the laboratory, without cost to the Owner, adequate samples of materials proposed for use which are required to be tested.

C. Advise laboratory sufficiently in advance of construction operations to allow laboratory to complete any required checks or tests and to assign personnel for field inspection and testing as specified.

D. Provide facilities for safe storage and proper curing of concrete test samples on project site for the first 24 hours and also for subsequent field curing as required by ASTM specifications C31.

E. Provide incidental labor and equipment as required to assist laboratory personnel in obtaining and handling samples at the site and in accessing work for inspection.

F. Furnish concrete mix designs, in accordance with ACI 301, section 3.9, made by an independent testing laboratory or qualified concrete supplier. Where mix designs are required, the laboratory shall be selected and paid by the Contractor.

G. Provide current welder certifications for each welder to be employed.

H. Furnish fabrication and erection inspection of all welds in accordance with AWS D1.1, Chapter 6.

I. Prequalification of all welding procedures to be used in executing the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PIER DRILLING

A. A representative of the Owner's Geotechnical Engineer shall provide the services specified in this section.

B. The laboratory representative shall make continuous inspections to determine that the proper bearing stratum is obtained and that shafts are clean and dry before placing concrete.

C. The laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, whether or not casing is required, bell size (if required), actual penetration into bearing stratum, and elevation of top of bearing stratum.

3.2 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspect all concrete reinforcing steel prior to placing of concrete for compliance with the Contract Documents and approved shop drawings. All instances of noncompliance shall be immediately brought to the attention of the Contractor for correction. If uncorrected by the Contractor, they shall be listed in the report.

B. Observe and report on the following:

1. Number and size of bars
2. Bending and lengths of bars
3. Splicing
4. Clearance to forms including chair heights
5. Clearance between bars or spacing
6. Rust, form oil, and other contamination
7. Grade of Steel
8. Securing, tying and chairing of bars
9. Excessive congestion of reinforcing steel
10. Installation of anchor bolts and placement of concrete around anchor bolts
11. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
12. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents

C. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three years experience inspecting reinforcing steel in projects of similar size.

3.3 REINFORCING STEEL MECHANICAL SPLICES

A. Each mechanical splice shall be visually inspected to ensure compliance with the ICBO Reports and the manufacturer's published criteria for acceptable completed splices.

B. Special emphasis shall be placed on inspection of the end preparation of each bar to be spliced, as required by the ICBO report.

C. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and whether splice is accepted or rejected. Reasons for rejection shall be shown on each report.

3.4 CONCRETE INSPECTION AND TESTING

A. Secure composite samples of concrete at the jobsite in accordance with ASTM C172.

B. Mold and cure specimens from each sample in accordance with ASTM C31. The test cylinders shall be stored in the field 24 hours and then carefully transported to the laboratory and cured in accordance with ASTM C31.

C. Test specimens in accordance with ASTM C39. Two specimens shall be tested 7 days, two specimens shall be tested at 28 days for strength acceptance. A spare cylinder shall be made and kept for a 56-day break if the 28-day break does not meet strength requirements. If the plans require 56-day break (such as for mass concrete), two samples shall be tested at 56 days for acceptance.

D. Make one strength test (four or five cylinders) for each:

1. 100 cubic yards or fraction thereof, of each mix design placed in one day.
2. OR, for each 5000 sq. ft. of slab area placed in one day.
3. When the total quantity of a given class of concrete is less than 25 cu. yds., the strength tests may be waived by the Architect/Engineer, if in his judgment, adequate evidence of satisfactory strength is provided.

E. Make one slump test for each set of cylinders following the procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever the consistency of the concrete appears to vary. Do not permit placement of concrete having measured slump outside the limits given on the drawings, except when approved by the Architect. Slump tests corresponding to samples from which strength tests are made shall be reported with the strength test results. Other slump tests need not be reported.

F. Determine total air content of air entrained normal-weight concrete sample for each strength test in accordance with ASTM C231.

G. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.

H. Determine temperature of concrete sample for each strength test and one test for each concrete load discharged when air temperature is 80 degrees F. and above.

I. Monitor the addition of water at the jobsite and the length of time the concrete is allowed to remain in the truck before placement. Report any significant deviation from the approved mix design and the project requirements to the Architect, the Contractor, and the Concrete Supplier.

J. Monitor the slump and air content of the concrete. If the measured slump or air content of air entrained concrete falls outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed to meet the project requirements and specifications and shall be rejected.

K. The testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and the time at which the cement and aggregate was dispensed into the truck, and the time at which concrete was discharged from the truck.

L. Laboratory reports shall contain the following information:

1. Class of concrete and specific location.
2. Specified strength of concrete.
3. Air temperature.
4. Batch time.
5. Specified time that discharge of concrete must be completed, based on air temperature.
6. Time concrete is placed.
7. Amount of water withheld at the plant for latter addition at the project site (Note that the total amount of water shall not exceed the maximum water/cement ratio for the approved mix design).
8. Amount of water added at the site.
9. Allowable slump range on the approved mix design.
10. Slump.
11. Maximum and minimum allowable concrete temperature on the approved mix design.
12. Temperature of the concrete mix.
13. Air content range on the approved mix design.
14. Air content.
15. Statement that concrete is in compliance with the project documents and the approved mix designs.

M. Evaluation and Acceptance:

1. The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results are equal to or exceed the specified strength and no individual test result (average of two cylinders) is below the specified strength by more than 500 psi.
2. Completed concrete work will be accepted when the requirements of "Specifications for Structural Concrete for Buildings," ACI 301 have been met.

N. Observe the placing of all concrete, except site work. Observe and report on placing method, consolidation, cold joints, length of drop and displacement of reinforcing. Report deficiencies to the Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.

O. Comply with ACI 311, "Guide For Concrete Inspection" and "ACI Manual of Concrete Inspection" (SP-2).

P. Inspect the application of curing compound and monitor all curing conditions to assure compliance with Specification requirements. Report curing deficiencies to the Contractor immediately and submit a report to the Architect.

3.5 MASONRY

A. Inspection

1. Provide a qualified inspector to inspect all structural masonry work.
   a. Inspect masonry for compliance in accordance with the “Level 1 or 2 Special Inspection” provisions of the building code. Refer to the contract documents regarding which level of special inspections is required.
2. In combination with inspections required by the building code, inspect the following:
   a. Preparation of masonry prisms for testing.
   b. Placement of reinforcing.
   c. Cavities to be grouted (prior to grouting and prior to closing cleanouts).
   d. Mortar mixing operations, including proportion of materials and method of measuring materials (materials should be measured with a mixing box and not a shovel).
   e. Bedding of mortar for each type of unit and placing of units.
   f. Grouting operations.
   g. Condition of units before laying for excessive absorption.
3. Provide report of each inspection.

B. Field Compressive Tests for Grout:

1. Secure composite samples of grout at the jobsite in accordance with ASTM C 1019.
2. Mold and cure three specimens from each sample in accordance with ASTM C 1019. Supervise the curing protection provided (by others) for test specimens in the field and the transportation from the field to the laboratory. The test specimens shall be stored in the field 24 to 48 hours and then be carefully transported to the laboratory and cured in accordance with ASTM C 1019.
3. Test specimens in accordance with ASTM C 1019. Two specimens shall be tested at 28 days for acceptance and one specimen shall be tested at 7 days for information.
4. Make one strength test (three specimens) for each 10 cubic yards of grout poured but not less than one strength test for each 5000 square feet of wall area.

C. Prism Tests:

1. Build prisms at the jobsite using the same materials and methods as being used for the wall construction. Store prisms in a place where they will be undisturbed for two days and have approximately same curing conditions as masonry construction. After 48 hours, move prisms to the laboratory and test in accordance with ASTM C1314.
2. Make prism tests in advance of operations using materials under same conditions, with the same bonding and construction methods as is being used for the structure. When building prisms, moisture content of the units at time of laying, consistency of mortar and width and thickness of mortar joints shall be same as used in the structure.
3. Build prisms of hollow masonry units the same width as unit by 16" long by 16" high. Apply mortar to face shells only. Do not fill hollow core with grout. Compute value of ultimate net compressive strength, by dividing ultimate load by net face shell area of masonry units.
4. Cure and test prisms in accordance with applicable provisions of ASTM C1314. Test five specimens of each type of masonry unit before delivering material to the jobsite and submit results for approval. During construction, test three specimens of each type of masonry unit for each 5000 square feet of wall placed.
5. The prisms shall be tested after 28 days but may be tested at seven days provided the relationship between seven and 28 day strengths has been established for the materials used prior to the start of construction.

6. When the average strength of a set of prisms falls below the specified compressive strength (f'm), the masonry corresponding to the test shall be deemed unacceptable. In such a case, notify the Architect and Contractor immediately.

3.6 STRUCTURAL STEEL

A. Inspect all structural steel during and after erection for conformance with Contract Documents and shop drawings.

B. Field Inspection

1. Proper erection of all pieces.
2. Proper installation of all bolts, including the checking of calibration of impact wrenches used with high strength bolts.
3. Plumbness of structure and proper bracing.
4. Field Painting.
5. Visual examination of all field welding.
6. Ultrasonic testing of all penetration welds.
7. Installation of field welded shear studs.
8. Measure and record camber of all beams upon arrival and before erection for compliance with the specified camber. Measure lying flat with web in horizontal position. Members outside specified camber tolerance shall be returned to the shop for remedial work.

C. Qualification of Welders: Fabricator and erector shall provide the testing laboratory with names of welders to be employed in the work, together with certification that welders have passed qualification tests within the last year using procedures specified in the AWS D1.1. Testing laboratory shall verify all welder's qualifications.

D. Inspection of shop and field welding shall be "verification inspection," in accordance with Section 6 of AWS D1.1 and as follows:

1. Visually inspect the welding of all shop fabricated members and note the location of all cover plates, connectors, bearing stiffeners, splices, and fillet welds for proper return around ends and check for seams, folds, and delamination.
2. Ultrasonically test all penetration welds in accordance with AWS D1.1.
3. Inspect surfaces to be welded. Surface preparations, fit-up and cleanliness of surface shall be noted.
4. The welding inspector shall be present during alignment and fit-up of members being welded and shall check for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, the inspector shall order the joint to be chipped down to sound metal or gouged out and rewelded. Root passes shall be thoroughly inspected for cracks. All cracks shall be gouged out and rewelded to two inches beyond each end of crack.
5. The inspector shall check that all welds have been marked with the welder’s symbol. The inspector shall mark the welds requiring repairs and shall make a reinspection. The inspector shall maintain a written record of all welds. Work completed and inspected shall receive an identification mark by the inspector.
6. The testing laboratory shall advise the Owner and the Architect of any shop and/or field conditions which, in his opinion, may require further tests and examination by means other

than those specified. Such further tests and examinations shall be performed as authorized by the Owner and the Architect.

7. The Owner reserves the right to use ultrasonic or radiographic inspection to verify the adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.

E. Inspection of bolted construction shall be in accordance with AISC "Specification for Structural Steel Buildings" and as follows:

1. All bolts shall be visually inspected to ensure that the plies have been brought into snug contact.
2. High strength bolting shall be inspected in accordance with Section 9 of the AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
3. For all high strength bolts, unless specifically noted on the Drawings to require only "snug-tight" installation, the inspector shall observe the required jobsite testing and calibration and shall confirm that the procedure to be used provides the required tension.
4. For slip critical connections, inspect the contact surfaces for compliance with specifications prior to bolting.

F. Inspection of stud welding shall be in accordance with Section 7.8 of AWS D1.1 and as follows:

1. A minimum of two shear studs shall be welded at the start of each day’s production period in order to determine proper generator, control unit and stud welding setting. These studs shall be capable of being bent at 45 degrees from vertical without weld failure.
2. When the temperature is below 32 degrees Fahrenheit, one stud in each 100 shall be tested after cooling. Studs shall not be welded below zero degrees Fahrenheit or when the surface is wet due to rain, snow, or ice. If a stud fails, two new studs shall pass the test before resumption of the welding.
3. Visually inspect studs for compliance with the Contract Documents. Check number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360-degree fillet has not been obtained for a particular stud, such stud shall be struck with a hammer and bent 15 degrees off perpendicular. Studs failing this test shall be replaced.

3.7 OPEN WEB JOISTS AND JOIST GIRDERS

A. Inspect all joists either in the plant or at the jobsite for conformance with specified fabrication requirements. Check welded connections between web and chord, splices, and straightness of members. Inspection at the plant may be performed by the manufacturer’s qualified QC personnel.

B. Inspect installation of joists at the jobsite. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for conformance with the Contract Documents and referenced standards.

C. Check welder qualification certificates for field welding operators.

3.8 STEEL FLOOR DECK

A. Field Inspection shall consist of the following:

1. Check types, gauges, and finishes for conformance with the Contract Documents and shop drawings.
2. Examination of proper erection of all metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting or other coating.
3. Certification of welders.
4. Field welded shear studs used to fasten metal floor decking to supporting steel shall be inspected and tested as described in the structural steel section of this specification section.

3.9 STEEL ROOF DECK

A. Field inspection shall consist of the following:

1. Checking types, gauges, and finishes for conformance with the Contract Documents and Shop Drawings.
2. Examination for proper erection of all metal deck, including fastenings at supports and sidelaps, reinforcing of holes, and miscellaneous deck supports.
3. Certification of welders.
4. Visual inspection of at least 20 percent of all welds.

3.10 SPRAYED FIREPROOFING

A. Verify that applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.

B. Verify that installation meets fire rating requirements of approved design.

C. Inspect and test for thickness as follows:

1. Test 20 percent of structural frame columns and beams in each building level.
2. Test 10 percent of beams other than structural frame in each building level.
3. Test one slab per each 5000 square feet of building area.

D. Inspect and test for density on slabs, beams, and columns. Perform one of each test for each 10,000 square feet of building area.

E. Inspect and test for bond strength, one test for beams and one test for slabs for each 10,000 square feet or area.

F. Inspection and test procedures shall be performed in accordance with ASTM E605 and E736.

3.11 EXPANSION BOLT INSTALLATION

A. Inspect the drilling of each hole and installation of each expansion bolt for compliance with the Contract Documents.

B. Verify the installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

3.12 TESTING OF NON-SHRINK GROUT

A. Make one strength test for every 15 base plates grouted and for every 15 bags of grout used in joints between members.

B. Each test shall consist of four cubes, two to be tested at seven days, and two at 28 days, made and tested in accordance with ASTM C109, with the exception that the grout shall be restrained from expansion by a top plate.

3.13 EXCAVATION

A. A representative of the Owner's Geotechnical Engineer shall provide the services specified in this section.

B. Review geotechnical parameters and assumptions used in the development of calculations and drawings for retention systems, including lateral design forces, rock wedge stability analysis, rock bolt lengths and spacing, and surcharge effects.

C. Observe the excavation process, the exposed faces of the excavation and the installation of retention systems. Check for compliance with the Contract Documents and make alternative recommendations as may be required to suit field conditions.

D. Review required submittals as they pertain to geotechnical requirements.

E. Check the adequacy and accuracy of the Contractor's monitoring program, equipment, procedures, and measurements related to movements of the excavated face and adjacent structures.

F. Immediately report any observed unsafe conditions. Request additional shoring, bracing, or rock bolting where judged to be necessary as the excavation progresses.

3.14 WATER PRESSURE INJECTION OR LIME SLURRY PRESSURE INJECTION

A. The representative of the Owner's Geotechnical Engineer shall make continuous observations throughout the injection operations as per the geotechnical report.

B. The representative of the Owner's Geotechnical Engineer may propose to perform additional tests if required to properly evaluate the injected soil. The representative of the Owner's Geotechnical Engineer shall evaluate the results of the tests to determine the acceptability of the injected areas and to determine if additional injections are required.

3.15 FILLING AND BACKFILLING

A. A representative of the Owner's Geotechnical Engineer shall provide the services specified in this section.

B. The Contractor shall make available to the laboratory, adequate samples of each fill and backfill material from the proposed sources of supply not less than 10 days prior to the start of the work.

C. Laboratory shall analyze samples as required to provide a soil description and to determine compliance with quality requirements. Perform the following tests:

1. Test for liquid limit in accordance with ASTM D423.
2. Test for plastic limit of soils and plasticity index of soils in accordance with ASTM D424.
3. Tests for moisture density relations of soil in accordance with ASTM D698 or D1557, as applicable.

D. Furnish a report for each individual test and state whether sample conforms to specified requirements or reasons for nonconformance.

E. Inspect under slab drainage material and placement for compliance with specified gradation, quality, and compaction.

F. Make in-place compaction test for moisture content, moisture-density relationship, and density of fill material after compaction to determine that backfill materials have been compacted to the specified density. Number of tests shall be as follows:

1. One test for each 5000 square feet of area of each lift placed under floor slab. Stagger test locations in each lift from those in the previous lift. Perform a minimum of three tests for each lift.
2. One test for each 150 linear feet, or portion thereof, of each lift placed against foundation walls, with locations staggered from those in the previous lift.
3. One test of each lift placed below any isolated footing, and every 100 linear feet under continuous footings, with locations taken on a different side from that in the lift below.

3.16 TILT-UP PANELS

A. Concrete Reinforcing Steel and Embedded Metal Assemblies: Inspect in accordance with the Concrete Reinforcing Steel and Embedded Metal Assemblies section of this Specification.

B. Concrete Inspection and Testing: Perform in accordance with the Concrete and Inspection and Testing section of this specification.

C. Inspection of Tilt-up concrete during erection:

1. Inspect members for cracks, spalls, and other deficiencies after erection.
2. Inspect erection of tilt-up members for placement tolerances, and to ensure that connections, bearing lengths, welding and grouting conform to the Contract Documents.

3.17 POST-TENSIONING

A. Verify certification of calibration of jacking equipment used in post-tensioning operations.

B. Observe and report on placement and anchorage of tendons immediately prior to concreting.

C. Provide a qualified, experienced inspector to observe the stressing and elongation measurement of each tendon. Inspector shall have a minimum of five years' experience inspecting post-tensioning operations.

D. The Contractor shall log and submit detailed reports of the stressing and elongation of each tendon. The laboratory representative shall observe the recording of information by the Contractor and make such spot checks as necessary to verify the accuracy of the post tensioning reports.

E. Receive and review final stressing and elongation reports prepared by the contractor. Compare the actual and required elongation of each tendon and the actual and required load on each tendon. Grant permission to cut tails of tendons which are within the specified tolerance, unless otherwise noted on the Drawings, and submit reports of those which are not within the specified tolerance to the Architect for further evaluation.

F. Observe and report on grouting of tendons noted to be bonded.

G. Reports shall be submitted to the Architect within 48 hours after stressing.

H. The post-tensioning subcontractor shall provide a letter at the completion of the project, signed and sealed by a registered engineer in the state of the project, stating that the post-tensioning work was completed in accordance with the contract documents. The post-tensioning subcontractor shall review the stressing records and certify that the required forces shown on the contract documents have been provided.

3.18 FOOTING EXCAVATIONS

A. A representative of the Owner's Geotechnical Engineer shall inspect each footing excavation to determine that the proper bearing stratum is obtained and that excavations are properly clean and dry before the concrete is placed.

3.19 EXISTING FOUNDATION DEMOLITION

A. While it is common for the testing and inspections laboratory to be involved and on-site during earthwork prep. and operations; (including but not limited to: observing and testing earthwork properties, select fill properties, thicknesses, compaction, moisture content, etc.) We also require the testing and inspections laboratory to be on-site for the infill of any and all demolished foundation items, both partially and fully demolished. We have observed instances where the demo contractor did not properly/adequately infill the sub-grade voids and/or compact the infill from existing demolished foundations. When the new building was constructed, the inadequate fill/compaction led to water intrusion problems and questionable bearing. We require that the testing and inspections laboratory be on-site to observe and test the infill of the existing foundations to reasonably ensure that the bearing values recommended in the geotechnical report can be achieved.

1. The owner shall be aware that this additional testing inspection scope will be required.

2. The general contractor shall inform the demolition contractor(s) that the infill of the demolished foundations will be required to meet the earthwork requirements and be testing for compliance and any additional cost associated with ensuring the infill meets these parameters shall be included in their base bid.

END OF SECTION 01 45 23

SECTION 01 57 23
STORM WATER POLLUTION PREVENTION PLAN (SWP3)

Project Name and Location:
Name: Middle High School No. 8
Location: FM 359 near Fort Bend County & Waller County line.
Fulshear, TX

Owner Name and Address:
Lamar Consolidated Independent School District
3911 Avenue I
Rosenberg, Texas 77471

Contractor (Construction Site Operator) Name and Address:

_____

_____

_____

1.0 Site Description

a. Description of the Construction Activity:
The project includes the Construction of a new High School building with supporting utilities, paving, and sports complexes. This work is to be completed under TPDES General Permit TXR150000 under responsibility of the Contractor.

b. Potential Pollutants and Sources
The following substances are expected to be present onsite during construction: concrete, petroleum-based products, fuels, lubricants, fertilizers, detergents, wood, soil stabilizing additives, pesticides, acids, concrete additives, and concrete truck washout. The following are sources of the previous substances listed: construction equipment, construction materials, disturbed soil, and vehicles onsite.

c. Sequence of Major Activities:
The major phase of work will incorporate excavation and construction of underground utilities, building slab, site grading and site paving. This "PPP" will be in effect during this time.

d. Estimated Total Site Area, Total Disturbed Area:
The total area of the site is 37.46 acres. Approximately 60% of this area will be disturbed during the construction.

e. Runoff Coefficient:
The pre-construction runoff coefficient of the project site is 0.20 while the post-construction coefficient is 0.62.

f. Site Map:
The site and vicinity maps are shown on the construction plans.

g. Name of Receiving Water, and Extent of Wetlands:
The receiving water for the subject site is to Brookshire Creek, which is a tributary of the Brazos River. There are no existing wetland areas on the site.

2.0 Controls

General Provisions to be complied with on-site:

(1) Sediment will be retained on-site to the maximum extent practicable.

(2) Control measures will be properly selected, installed, and maintained in accordance with manufacturer's specifications and good engineering practice. If damaged or rendered ineffective during site development, erosion and sediment controls will be repaired or replaced immediately.

(3) When dewatering (pumping) the site, the sediment-laden discharge will be detained for a sufficient time to allow the majority of the sediment to settle out. Direct discharge into a storm sewer will not be allowed.

a. Erosion and Sediment Controls

(1) Stabilization Practices

1. A temporary construction access road will be stabilized using coarse aggregate, if necessary. All vehicles entering or leaving the site will utilize this access drive.

2. Hydromulch seeding will be applied immediately after construction activities on all exposed soils. Water will be applied on a weekly basis unit 70% of new growth is observed.

(2) Structural Practices

1. Reinforced filter fabric fencing and inlet protection barriers will be installed and maintained on a weekly basis until the completion of all construction activities and when 70% of new seeding growth is observed. The locations of these devices are shown on the Storm Water Pollution Prevention Plan or as directed by the Engineer.
   a. Filter fabric fencing shall be placed around any earth or base material stockpile while it is in use and along the property lines.
   b. Filter fabric fencing shall be placed around the outfall pipe, inlets and across drainage ditches/swales.

2. Reinforced filter fabric fencing is to be used to protect any existing inlets within 100 feet of the project area, or as shown on the Storm Water Pollution Prevention Plan.

3. Inlet protection barriers are to be placed at each inlet upstream and downstream of each street crossing.

Sequence of Major Erosion and Sediment Control Activities

The reinforced filter fabric barriers, stabilized construction access locations, and inlet protection will be in place before excavation activity begins.

b. Storm Water Management – Post Construction

(1) At the end of this project, disturbed areas of the site will be seeded with hydromulch seeding providing flow attenuation and partial vegetation filtration.

(2) Storm water from the finished project will discharge by overland flow to on-site inlets and then to the public storm sewer on Barzun Way.

c. Other Controls

(1) Waste Disposal

Waste Materials
All waste materials will be collected, stored and disposed of in a securely lidded metal dumpster. The dumpster will meet all local and state solid waste management regulations. No construction waste material will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal.

Hazardous Waste
No hazardous waste is expected to be generated or encountered in this project. In the event that hazardous waste is encountered, the Owner will be notified immediately. All hazardous waste materials will be disposed of in the manner specified by local or state regulations or by the manufacturer.

Sanitary Waste
All sanitary waste will be regularly collected from portable units by a licensed sanitary waste management contractor.

(2) Offsite Vehicle Tracking

A stabilized construction entrance will be provided to help reduce vehicle tracking of sediments. The paved streets adjacent to the site entrance will be cleaned daily, if necessary, to remove any excess mud, dirt, or rock tracked from the site.

(3) Dust Control and Street Cleaning

Dust will be minimized by using water trucks to keep the ground moist, if necessary. Watering will be limited to prevent excessive runoff of water from dust control. Silt fencing will prevent water from this activity from washing dust into the storm drain. For sediment accumulations on new internal paved streets and surfaces, as well as off-site accumulations, using sweepers or other devices to remove sediment by creating airborne dust and sediment is not acceptable. The accumulations must be cleaned up by hand, or with a vacuum truck. Sediment removed by hand can be returned to the site provided it is placed behind an adequate control device such as a filter fence. Under no circumstances will sediment be washed, shoveled, or otherwise introduced into a drainage system

during clean up.

The paved streets adjacent to the site entrance will be cleaned daily, if necessary, to remove any excess mud, dirt, or rock tracked from the site.

(4) Water line Flushing

Reinforced silt fencing or other control measures to be provided to prevent the runoff of excess sediment into storm drain during water line flushing.

(5) Demonstration of Compliance with State and Local Regulations

The proposed project will be in compliance with applicable state and local waste disposal and sanitary sewer regulations.

d. Approved State or Local Plans

(1) This work is to be completed under TPDES General Permit TXR150000.

(2) The Storm Water Pollution Prevention Plan will be updated as necessary by the Operator to remain consistent with any changes applicable to protecting surface water resources.

3.0 Maintenance

The following is a list of erosion and sediment controls implemented on this project that require maintenance:

Stabilization Practices

Stabilization of construction access area.

Hydromulch seeding.

Structural Practices

Reinforced filter fabric fences.

Inlet protection barriers around inlets.

Gravel bags/hay bales on either side of existing and proposed curb inlets.

To maintain the above practices, the following will be performed:

1. Maintenance and repairs will be conducted within 24 hours of inspection report (see Section 4.0 below).

2. Sediment will be removed from behind the sediment fences when it becomes about 1/3 the height of the fence.

3. Erosion and sediment control measures that have been improperly installed or have been disabled, run-over, removed, or otherwise rendered ineffective must be replaced or corrected immediately.

4.0 Inspections

a. The Contractor will designate a qualified person or persons to perform the following inspections:

(1) Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system.

(2) Erosion and sediment control measures identified in the plan will be observed to ensure that they are operating correctly.

(3) Where discharge locations or points are accessible, they will be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

(4) Locations where vehicles enter or exit the site will be inspected for evidence of offsite sediment tracking.

(5) Erosion and sediment control measures that have been improperly installed or have been disabled, run-over, removed, or otherwise rendered ineffective must be replaced or corrected immediately.

The inspection will be conducted by the responsible person at least once every seven (7) calendar days and within 24 hours after a storm of 0.5 inch or greater.

After a portion of the site is finally stabilized, inspection will be conducted at least once every month.

b. Based on the results of the inspection, the site description (Section 1) and control measures (Section 2) of this "SWP3" will be revised as appropriate, but in no case later than 7 calendar days following the inspection.

c. A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with item "b" above will be made and retained as part of the storm water pollution plan for at least three years from the date that the site is finally stabilized. The report will be signed in accordance with Part VI.G of the General Permit.

Copies of the forms to be used for the Inspection and Maintenance report are included in the following pages as a part of this "SWP3."

STORM WATER POLLUTION PREVENTION PLAN (SWP3)
INSPECTION AND MAINTENANCE REPORT

INSPECTOR:_____ DATE:_____
DAYS SINCE LAST RAINFALL:_____ AMOUNT OF LAST RAINFALL:_____INCHES

STABILIZATION MEASURES

AREA	DATE SINCE LAST DISTURBED	DATE OF NEXT DISTURBANCE	STABILIZED?	STABILIZED WITH	CONDITION

STABILIZATION REQUIRED:_____

TO BE PERFORMED BY:_____ ON OR BEFORE:_____

STRUCTURAL CONTROLS
INLET PROTECTION BARRIERS:

LOCATION	IN PLACE? / CONDITION?	DEPTH OF SEDIMENT	CONDITION OF INLET

MAINTENANCE REQUIRED FOR INLET PROTECTION BARRIER:_____

TO BE PERFORMED BY:_____ ON OR BEFORE:_____

STRUCTURAL CONTROLS
FILTER FABRIC FENCE:

LOCATION	BOTTOM OF FABRIC STILL BURIED?	FABRIC TORN OR SAGGING?	POSTS TIPPING OVER?	HOW DEEP IS THE SEDIMENT?

MAINTENANCE REQUIRED FOR SILT FENCE:_____

_____

TO BE PERFORMED BY:_____ ON OR BEFORE:_____

OTHER CONTROLS
STABILIZED CONSTRUCTION ENTRANCE/STAGING AREA:

DOES MUCH SEDIMENT GET TRACKED ONTO ROAD?	ENTRY SURFACE CLEAN OR SEDIMENT FILLED?	DOES ALL TRAFFIC USE ENTRANCE?

MAINTENANCE REQUIRED FOR STABILIZED CONSTRUCTION ENTRANCE/STAGING AREA:

_____

TO BE PERFORMED BY:_____ ON OR BEFORE:_____

CHANGES REQUIRED TO THE POLLUTION PREVENTION PLAN:_____

_____

REASONS FOR CHANGE:_____

_____

- **BASED ON MY INSPECTION, THE SITE IS IN GENERAL CONFORMANCE WITH THE SWP3 AND TPDES GENERAL PERMIT TXR150000.**
- **UPON COMPLETION OF THE ABOVE MAINTANCE AND MODIFICATIONS, THE SITE WILL BE IN GENERAL COMFORMANCE WITH THE SWP3 AND TPDES GENERAL PERMIT TXR150000.**

INSPECTOR'S SIGNATURE:_____ **DATE:**_____

TITLE:_____

5.0 Non-Storm Water Discharges

Inventory for Storm Water Pollution Prevention Plan
The following substances listed below are expected to be present onsite during construction:

Concrete	Fuels	Petroleum Products	Fertilizers
Detergents	Lubricants	Wood	Metals

Spill Prevention
The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of the materials and substances described above to storm water runoff.

Good Housekeeping
The following good housekeeping practices will be followed onsite during the construction project.

1. An effort will be made to store only enough product required to do the job.
2. All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Products will be kept in their original containers with the original manufacturer's label.
4. Substances will not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product will be used up before disposing of the container.
6. Manufacturers' recommendations for proper use and disposal will be followed.
7. The site superintendent will inspect daily to ensure proper use and disposal of materials onsite.

Hazardous Products
These practices will be used to reduce the risks associated with hazardous materials, if hazardous materials are used.

1. Products will be kept in original containers unless they are not resealable.
2. Original labels and material safety data will be retained.
3. If surplus product must be disposed of, manufacturers' or local and state recommended methods for proper disposal will be followed.

Product Specific Practices
The product specific practices to be followed are listed in Table 1.

Spill Prevention Practices
The spill prevention practices to be followed are listed in Table 1.

STORM WATER POLLUTION PREVENTION PLAN (SWP3) CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____

Printed Name: _____

Company: _____

Title: _____

Date: _____

CONTRACTOR/SUB-CONTRACTOR CERTIFICATION

Approximate location of Site:

The project is located on FM 359, near the Fort Bend County and Waller County line, Texas. (Key Map No. 482P).

Latitude: **29º30'54" N**
Longitude: **95º51'40" W**

I certify under penalty of law that I understand the terms and conditions of the Texas Pollutant Discharge Elimination System (TPDES) General Permit TXR150000 that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

Signature:	For:	Responsible for:
_____	Contractor's Name	

Name: _____

Title: _____

Date: _____

INSPECTOR CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____

Name: _____

Inspector: _____

Company: _____

Date: _____

TABLE 1

Product Specific Practices

The following product specific practices will be followed onsite:

Petroleum Products:

All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

Fertilizers:

Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked in the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

Paints:

All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to manufacturers' instructions or state and local regulations.

Spill Prevention Practices

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

- Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite. Equipment and materials will include but not be limited to brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.

- All spills will be cleaned up immediately after discovery.

- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

- Spills of toxic or hazardous material will be reported to the Owner and to the appropriate State or local government agency, regardless of the size.

- The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.

- The site superintendent responsible for the day-to-day site operations will be the spill prevention and cleanup coordinator. He will designate at least three other site personnel who will receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the office trailer onsite.

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for selection of products, including but not limited to:
   1. Product delivery, storage, and handling.
   2. Manufacturers' written warranties on products.
   3. Special warranties.
   4. Comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, *assembly*, and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis of Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words *basis of design product*, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the specified requirements.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 01 33 00.
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal: Comply with requirements in Section 01 33 00. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long term storage at site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and items needed for complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term “as selected”, Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and characteristics based on the product named. Comply with requirements for consideration of an unnamed product by one of the named manufacturers.

C. Visual Matching Specification: Where Specifications require “*match Architect's sample”*, provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with specified requirements, comply with requirements of Section 01 25 00 for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase “*selected by Architect”* or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

NOT USED

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair Work required to restore construction to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

C. Certified Surveys: Submit two copies signed by land surveyor.

D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor legally qualified to practice in the State of Texas, who is experienced in providing land surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not warranted. Before beginning site Work, investigate and verify existence and location of underground utilities, mechanical and electrical systems, and construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water service piping; underground electrical services, and other utilities.
2. Furnish location data for Work related to the Work that must be performed by public utilities serving the site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation after correcting unsatisfactory conditions. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as necessary to locate each element of Project.
2. Establish limits on use of site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical Work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control Work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other Work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical Work plumb and make horizontal Work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions ensuring the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.

   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous. Materials containing asbestos and BCPs are prohibited.

3.6 OWNER INSTALLED PRODUCTS

A. Site Access: Provide access to site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with Work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's Work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. Clean site and Work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F (27 degrees C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with mechanical, plumbing, and electrical requirements.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00.

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 73 29 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Procedural requirements for cutting and patching.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair Work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Products: List products used for patching and firms or entities that will perform patching Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
      a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

B. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

C. Operational Elements: Do not cut and patch operating elements and related components that results in reducing the capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   1. Primary operational systems and equipment.
   2. Fire separation assemblies.
   3. Air or smoke barriers.
   4. Fire suppression systems.
   5. Mechanical systems piping and ducts.

6. Control systems.
7. Communication systems.
8. Fire-detection and -alarm systems.
9. Conveying systems.
10. Electrical wiring systems.
11. Operating systems of special construction.

D. Miscellaneous Elements: Do not cut and patch the following elements or related components that change the load bearing capacity, resulting in a reduction of capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise and vibration control elements and systems.
7. Sprayed fire resistive material.

E. Visual Requirements: Do not cut and patch construction resulting in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
1. If possible, retain original Installer or fabricator to cut and patch exposed Work. If possible, engage original Installer or fabricator. If original installer is not available, engage recognized, experienced, and specialized firm for the Work.
   a. Processed concrete finishes.
   b. Ornamental metal.
   c. Matched veneer woodwork.
   d. Preformed metal panels.
   e. Roofing.
   f. Firestopping.
   g. Window system.
   h. Fluid applied flooring.
   i. Wall covering.
   j. HVAC enclosures, cabinets, or covers.

F. Cutting and Patching Conference: Before proceeding, meet at site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with specified requirements.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where removal, relocation, or abandonment is necessary, bypass existing services before cutting to avoid interruption of services to occupied areas.

3.3 CUTTING AND PATCHING

A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time, and complete without delay.
   1. Cut existing construction to provide for installation of components or performance of construction, and subsequently patch as necessary to restore surfaces to an original condition.

   2. Cut in place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of Work to be cut.

C. Protection: Protect in place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00.

E. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. Use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable earthwork specifications by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to eliminate evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions are removed, extend one finished area into another, patch and repair surfaces in new space. Provide even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
4. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
5. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
6. Exterior Building Enclosure: Patch components and restore enclosure to a weathertight condition.

END OF SECTION 01 73 29

SECTION 01 74 00 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous **demolition and construction** waste.
   2. Recycling nonhazardous **demolition and construction** waste.
   3. Disposing of nonhazardous **demolition and construction** waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. Salvage/ Recycle Requirements: Owner’s goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible without incurring additional costs for time delays to the Project. This includes the following materials.
   1. Demolition Waste:
      a. Asphalt paving.
      b. Concrete.
      c. Concrete reinforcing steel.
      d. Brick.
      e. Concrete masonry units.
      f. Wood studs.
      g. Wood joists.
      h. Plywood and oriented strand board.
      i. Wood paneling.
      j. Wood trim.
      k. Structural and miscellaneous steel.
      l. Rough hardware.
      m. Roofing.
      n. Insulation.
      o. Doors and frames.
      p. Door hardware.
      q. Windows.
      r. Glazing.

s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:
   a. Masonry and CMU.
   b. Lumber.
   c. Wood sheet materials.
   d. Wood trim.
   e. Metals.
   f. Roofing.
   g. Insulation.
   h. Carpet and pad.
   i. Gypsum board.
   j. Piping.
   k. Electrical conduit.
   l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
      1) Paper.
      2) Cardboard.
      3) Boxes.
      4) Plastic sheet and film.
      5) Polystyrene packaging.
      6) Wood crates.
      7) Plastic pails.

SUBMITTALS

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

PRODUCTS

Not used.

PART 2 - EXECUTION

2.1 PLAN IMPLEMENTATION

A. Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 01 50 00.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to everyone concerned within [**three**] days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Section 01 50 00 for the control of dust and dirt, environmental protection, and noise control.

2.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the work: Salvage items for reuse and handle:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items **Not permitted** on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

2.3 **RECYCLING** DEMOLITION AND CONSTRUCTION **WASTE**

A. Recycle paper and beverage containers used by on site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall **accrue to Contractor**].

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.

   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.

   5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

2.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.
   1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

2.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
   1. Clean Cut Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
      a. Comply with requirements in Section 32 93 00 for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
      a. Comply with requirements in Section 32 93 00 for use of clean ground gypsum board as inorganic soil amendment.

2.6 DISPOSAL OF WASTE

A. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on ite.

   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

END OF SECTION 01 74 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 PRE-CLOSEOUT MEETING

A. Pre-Closeout Meeting: Schedule and convene Pre-Closeout Meeting with Owner and Architect in accordance with Section 01 31 00, Project Coordination and Management.

1.3 SUBSTANTIAL COMPLETION

A. The items listed in the Supplementary Conditions, Paragraph 9.8 and the following items shall be completed before Substantial Completion will be issued:
   1. Contractor's (Punch List): Submit a thorough list of items to be completed or corrected, along with a written request for Substantial Completion and for review of the Work. The Architect/Engineer's Project Representative, at their discretion, may attend and assist in the preparation of the Contractor's Punch List.
   2. Architect's Supplemental Punch List: The Architect/Engineer, along with the Owner at the Owner's discretion, will inspect the Work utilizing the Contractor's prepared Punch List, noting completed items and incomplete items, and will prepare a supplemental list of items that have been omitted or incomplete items that were not previously noted.
   3. Operations and Maintenance Manuals: Submit as described in paragraph 1.3.
   4. Final Cleaning: Provide final cleaning and adequate protection of installed construction as described in paragraph 1.6 and 1.7.
   5. Starting of systems: Start up equipment and systems as described in paragraph 1.8.
   6. Testing and balancing: Testing and balancing of systems must be performed and completed and the report submitted and accepted by Architect/Engineer and Owner, as described in the Contract Documents. Make adjustments to equipment as required to achieve acceptance.
   7. Demonstrations: If required by individual specification sections or by Owner, provide demonstrations and instructions for use of equipment as described in paragraph 1.9.

B. Date of Substantial Completion: Complete or correct items identified on Punch List and confirm that all items have been corrected prior to Architects re-inspection. Architect/Engineer, along with the Owner, will re-inspect the corrected work to establish the Date of Substantial Completion. Incomplete items remaining will be appended to the Certificate of Substantial Completion (AIA G704). The Date of Substantial Completion represents day one (1) of the closeout period, and represents the date of commencement of the Contractors correctional period and all warranty periods as described and required by the Contract Documents, except as amended in the Certificate of Substantial Completion and elsewhere in the Contract Documents.

C. Certificate of Substantial Completion: When the Work or designated portion thereof is substantially complete, Architect will prepare the Certificate of Substantial Completion to be executed by the Owner and Contractor. Items on the appended Punch List shall be completed or corrected within the time limits established in the Certificate.

D. Within thirty (30) calendar days of substantial completion, contractor shall submit closeout submittals as required in accordance with this section.

1.4 PUNCH LIST

A. A comprehensive list prepared by the Contractor prior to Substantial Completion, and attached thereto, to establish all items to be corrected, or limited items of Work to be completed, if any. This list is intended to represent a limited number of items needing attention.

B. Punch lists shall be furnished to the Architect in Microsoft Excel and PDF formats. The punch list shall be in matrix form and shall include the following information for each punch list item:
   1. Room number or other suitable location identifier
   2. Description of the work
   3. Sub-contractor/trade sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
   4. Sub-contractor/trade sign-off date
   5. General contractor sign-off that the work has been verified to be I 00% complete and in accordance with the Contract Documents
   6. General contractor/trade sign-off date
   7. A/E consultant sign-off
   8. A/E consultant sign-off date
   9. If requested by the Owner, provide two additional similar columns for their sign-off.
   10. In the case of excessive repetition of the same item at various locations, the punch list may contain "general notes/items" that shall be applied to the entire project; and it shall be the responsibility of the contractor/sub-contractor to thoroughly examine the entire project and make corrective measures at all applicable locations.

C. Should the Architect determine that the Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to the Contractor for re-inspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the work to be done.

D. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

E. The Contractor's superintendent shall participate in the preparation of the Contractor's punch list that is submitted to the Architect and Owner for supplementation. Upon receipt, the Architect and Consultants shall perform a spot review to determine the adequacy and completeness of the Contractor's punch list.

F. Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent shall accompany the Architect, his Consultants and the Owner (at his discretion) during their observation and the preparation of their supplements to the Contractor's punch list.
   1. The Superintendent shall record or otherwise take note of all supplementary items.
   2. The Architect will endeavor to furnish to the Contractor typed, hand written or recorded supplements to the punch list in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect will not be cause for a claim for additional cost or extension of time as the Contractor's Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes.

1.5 OPERATIONS AND MAINTENANCE MANUAL

A. As a requirement for Substantial Completion, the final Operation and Maintenance Manual shall be submitted to, and reviewed and accepted by the Architect prior to issuance of the Certificate.

B. Submit one (1) copy of preliminary Operations and Maintenance Manuals to respective consultants (Civil, MEP, Structural, *etc*.) for review of conformance with contract requirements prior to submitting final to Architect. Allow time for proper review.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: An Organized chart listing all HVAC Equipment model numbers, serial numbers, shipment dates, startup dates, and warranty dates for the full unit, compressor, and heat exchanger as applicable.
   3. Part 3: Operation and Maintenance, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Equipment start-up instructions
      e. Operating instructions.
      f. Maintenance instructions for equipment and systems.
      g. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

   4. Part 4: Project documents and certificates, including the following:
      a. Product data.
      b. Air and water balance reports.
      c. Photocopies of warranties, certificates and bonds. Submit originals with Closeout Documents as specified below.

F. Submit one (1) final original and two (2) copies to Architect. The final original will be delivered to the Owner.

G. Contractor shall provide 2 flash drives, in PDF Format, the following documents after approval by the Architect, Consultants and Owner: closeout manual, MSDS binder, O&M Manuals, specifications and approved submittals. Documents shall be hyper-linked to the Table of Contents.

1.6 PROJECT CLOSEOUT PROCEDURES

A. Final Payment will not be authorized by the Architect until the Architect finds the Work acceptable under the Contract Documents, subject to the completion and acceptance of the following requirements and other applicable Contract requirements:
   1. Close-out Documents: Provide bound closeout documents as described in paragraph 1.5. Refer to the Supplementary Conditions, Paragraph 9.10 for additional information.
   2. Record Documents: Submit as described in paragraph 1.10.
   3. Extra materials: Provide extra stock, materials, and products as described in paragraph 1.11 when required by individual specification sections.
   4. Locks: Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner’s personnel of changeover in security provisions.
   5. Temporary Facilities: Discontinue and remove temporary facilities from the site, along with mockups, construction aids, and similar elements.

6. Warranties, Certificates and Bonds: Execute and assemble transferable warranty documents, certificates, and bonds from subcontractors, suppliers, and manufacturers as described in paragraph 1.12.
7. Final Inspection and Acceptance by Architect is achieved as described in paragraph 1.13.

1.7 CLOSEOUT DOCUMENTS

A. Coordinate the following items with the requirements of Supplementary Conditions of the Contract.

B. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

C. The close-out documents shall be neatly organized and easily useable as determined by the Architect and Owner. Separate Close-out Documents binders from Operations and Maintenance Manuals. Documents identified as "affidavit" shall be notarized.

D. Contents: Prepare Table of Contents for each volume, with each item description identified, typed on white paper, in five (5) parts as follows:
1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers. All General Contractor's vendors/suppliers and subcontractors that provided materials or performed any work related to this project must be listed on this form. Submit Final List of Subcontractors on Document AD.
2. Part 2: Closeout Documents and Affidavits, include the following:
   a. AIA G707 - Consent of Surety to Final Payment;
   b. AIA G706 - Contractor's Affidavit of Payment of Debts and Claims;
   c. AIA G706A - Contractor's Affidavit of Release of Liens;

3. Part 3: Project documents and certificates, including the following:
   a. Copy of Certificate of Substantial Completion (AIA G704);
   b. Copy of All Permits;
   c. Copy of Final Utility Bill or letter of transfer;
   d. Copy of Certificate of Occupancy;
   e. Copy of Certification of Project Compliance: Submit on attached **Close-out Form "B"**. Owner and Architect will initiate form and forward to Contractor for signature once Substantial Completion is established. (Owner to be provided original separately);

4. Part 4: Warranties, Release of Liens, compile sequentially based on specification sections:
   a. General Contractor's Warranty: Submit on company letterhead as described below. This Warranty shall state all sections of Work performed by General Contractor's own forces, and warranty period for each section of Work;
   b. Subcontractor's Release of Lien: Include contractor's, subcontractor's and direct material and equipment supplier's separate final releases. Submit on attached **Close-out Form "A"** – Subcontractor's Affidavit of Release of Lien.
   c. Hazardous Material Certificate: Submit on attached **Close-out Form "C"**. Affidavits from Contractor, Subcontractors and General Contractor's vendors or suppliers stating that no hazardous materials/products have been used or installed in this project.
   d. Subcontractor's Warranty: notarized, and submitted on attached **Close-out Form "D"**. This Warranty shall state all sections of Work performed by the subcontractor and warranty period.
   e. Special / Extended Warranties; List and provide, notarized warranties requested by Owner, or required by or incorporated in the Contract Documents.
   f. Spreadsheet depicting all items and materials that carry a warranty longer than one (1) year. Include information consisting of material/ supplier/ installer/ specification section/ length of warranty and contact information.

5. Part 5: Receipts:

a. Extra Stock: Provide original receipts for delivery of “Extra Stock” items as described below. Receipts must be signed by an authorized Owner’s representative;
b. Keys: Provide original receipts for delivery of “Keys”. Receipts must be signed by an authorized Owner’s representative.
c. Sign in sheets: provide signatures of attendees from all demonstrations.

E. Failure to complete and close-out project after substantial completion may result in liquidated damages being assessed to the Contractor. Refer to Conditions of the Contract for additional requirements and liquidated damages.

1.8 FINAL CLEANING

A. Execute final cleaning prior to final project inspection and acceptance.

B. Clean interior and exterior glass, and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces, mop hard floor surfaces.

C. Remove smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces

D. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

E. Clean and replace filters of operating equipment as required by Contract Documents

F. Clean debris from roofs, gutters, downspouts, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste and surplus materials, rubbish, and temporary construction facilities from site.

1.9 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections until Work is accepted by Architect and Owner.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.10 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Owner 48 hours prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of Contractors' personnel, and installer in accordance with manufacturers' instructions.

G. When specified in individual specification sections or required by manufacturer, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. When specified in individual specification sections or required by Owner or Architect/Engineer, submit a written report in accordance with Section 01 33 00, Submittal Procedures, that equipment or system has been properly installed and is functioning correctly.

1.11 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel a minimum of 48 hours prior to date of Final Completion in accordance with Owner’s requirements.

B. Demonstrate Project equipment instructed by qualified manufacturer's representative who is knowledgeable about the Project and equipment.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

D. Utilize maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.

F. Prepare and insert additional data in maintenance manuals when need for additional data becomes apparent during instruction.

G. Review and verify proper star-up and operation of equipment prior to scheduling demonstrations with Owner.

H. All demonstrations are to be documented by video and submitted to the Owner in DVD format along with the close out documents. General contractor is responsible for all video and compilation onto DVD with linked menus.

1.12 PROJECT RECORD DOCUMENTS

A. Project Record Documents, as described in Section 01 78 39, shall be submitted at Project Closeout. Final Payment will not be authorized by the Architect until final review and acceptance by Architect and Engineers is achieved in accordance with the Owners requirements.

B. Submit reproducible to respective consultants (Civil, Structural, MEP, *etc*.) for review. Consultant will mark-up corrections and return to Contractor for final revisions. Make final revisions prior to submitting to Architect.

1. Format: One (1) set of film positive reproducibles and two (2) sets bluelines of approved reproducibles.
2. Provide the Owner with one (1) set of Record Drawings on a non-rewritable CD in AutoCAD® latest release or BIM files per Owner's request.
3. Provide the Owner with one (1) set of Record Drawings on a on a non-rewritable CD in PDF format.
4. Label electronic BIM files and PDF files in the same manner as the sheets (example, A2.02 First Floor Area 'A', etc.)
5. Format: Submit all Project Record Documents as a bookmarked, indexed, searchable, annotated electronic PDF file.

1.13 EXTRA STOCK, MATERIALS AND MAINTENANCE PRODUCTS

A. Furnish extra stock, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site or to District Maintenance Department as directed by Owner; obtain signed receipt from Owner's authorized representative prior to final application for payment. Delivery of materials to, or obtaining receipt from anyone other than Owner's authorized representative may constitute breach of this requirement and may require delivery of additional materials at no cost to the Owner if original materials are misplaced.

C. Include signed receipts for delivery of extra stock and materials, including keys, with Closeout Documents.

1.14 WARRANTIES, CERTIFICATES AND BONDS

A. Definitions:
1. Standard Product Warranties: preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
2. Special Warranties: written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide coverage of specific defects, or both.

B. In accordance with the general warranty obligations under Paragraph 3.5 of the General Conditions as amended by the Supplementary Conditions, the General Contractor's warranty shall be for a period of one (1) year following the date of Substantial Completion, hereinafter called the one-year warranty period. The Contractors one-year general warranty shall include all labor, material and delivery costs required to correct defective material and installation. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

C. The Contractor's one-year warranty shall run concurrently with the one (1) year period for correction of Work required under Paragraph 12.2 of the General Conditions.

D. No service charges or call out charges are allowed to investigate warranty claims.

E. In addition to the Contractors one-year warranty, Special Warranties as described in individual specifications sections, shall extend the warranty period for the period specified without limitation in respect to other obligations which the Contractor has under the Contract Documents.

F. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve the suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

G. Warranty Requirements:

1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
2. When Work covered by a warranty has failed and been corrected by replacement or reconstruction, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
3. Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
4. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
5. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or designated portion of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

H. Compile copies of each required warranty properly executed by the Contractor and the subcontractor, supplier, or manufacturer. Verify documents are in proper form, contain full information, and are notarized. Co-execute warranties, certificates and bonds when required and include signed warrantees with Closeout Documents submitted to the Architect.

1.15 FINAL COMPLETION AND FINAL PAYMENT

A. Final Notice and Inspection:
1. When all items on the Punch List have been corrected, final cleaning has been completed, and installed work has been protected, submit written notice to the Architect that the Work is ready for final inspection and acceptance.
2. Upon receipt of written notice that the Work is ready for final inspection and acceptance, the Architect and Engineer will make final inspection.

B. Final Change Order: When the Project Closeout items described above are successfully completed and the Work is found acceptable to Architect/Engineer and Owner, a Final Change Order will be executed. This Change Order will include any Allowance adjustments as required by the Contract Documents.

C. Final Application for Payment: When all of the above items are successfully complete, submit to the Architect a final Application for Payment and request for release of retainage.

D. Release of Retainage: Release of retainage will not be authorized by the Architect until Contractor completes all requirements for close-out to the satisfaction of the Owner and Architect as described herein.

1.16 TERMINAL INSPECTION

A. Immediately prior to expiration of the one (1) year period for correction of the Work, the Contractor shall make an inspection of the work in the company of the Architect and the Owner. The Architect and the Owner shall be given not less than ten (10) days notice prior to the anticipated date of terminal inspection.

B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the Architect and the Owner, even if the date of completion of the corrective work may extend beyond the expiration date of the correction period.

C. The Contractor shall not be responsible for correction of work which has been damaged because of neglect or abuse by the Owner nor the replacement of parts necessitated by normal wear in use.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

PART 4 – SCHEDULE

Item	**Date of Issue**
Schedule of Closeout Conference	180 days before Substantial Completion
Operations & Maintenance Manuals	60 Days before Substantial Completion
Contractor's Punch List	Include with formal request for Substantial Completion.
As-Builts	30 Days after Substantial Completion
Affidavits	30 Days after Substantial Completion
Release of Liens	60 Days after Substantial Completion
Testing and Balance Report	60 Days after Substantial Completion
Warranty Forms	60 Days after Substantial Completion

END OF SECTION 01 77 00

SECTION 01 77 00 CLOSEOUT FORMS

CLOSE-OUT FORM "A"

SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the _____ of _____, the subcontractor who supplied, installed, and /or erected the work described below, and that, he /she is duly authorized to make this Affidavit and Subcontractor Release:

   Project: Middle School 8
   Owner: Lamar Consolidated Independent School District Architect: PBK
   Work Performed: _____ Specification Section(s): _____

2. That all work required under the subject subcontractor of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said subcontractor which have not been paid and satisfied in full.

3. That to the best of his / her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said subcontract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

4. That he / she has received full payment of all sums due him / her for materials furnished and services rendered by the undersigned in connection with the performance of said subcontract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said subcontract.

ATTEST (If Corporation)

_____
Name of Subcontractor

_____ _____
Secretary (By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

_____
(Seal) (Notary Public Signature)

CLOSE OUT FORM "B"

CERTIFICATION OF PROJECT COMPLIANCE

Completion of this form is required under the provisions of §61.1040 19 TAC for all public school district construction projects. Instructions for completion of this form can be found on page 2.

1. PROJECT INFORMATION

DISTRICT:

Facility:

ARCHITECT/ENGINEER:

Address:

CONTRACTOR/CM:

City:

CONTRACT DATE:

DATE DISTRICT AUTHORIZED PROJECT:

BRIEF DESCRIPTION OF PROJECT:

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies the following:

1.) The educational specifications of this facility presented to the school board of trustees were provided to the prime design professional in a timely manner.

2.) The long range facility plan was developed presented to the school board and provided in a timely manner to the prime design professional in a timely manner.

3.) That a design professional was hired to achieve the goals and expectations of the long range facility plan, and if applicable educational specifications.

4.) The safety and security standards were provided as a directive in a timely manner to the architect.

DISTRICT: **BY:** **DATE:**

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the project has been designed in reasonable accordance with the long range facility plan and educational specifications based on the School Facilities Standards as adopted by the Commissioner of Education, November 1, 2021, and as provided by the district. This includes the compliance path directives of section (g) or (h) and the safety and security directives in section (k) found in the above standard.

ARCHITECT/ENGINEER: **BY:** **DATE:**

5. The Contractor/CM the project has been built in reasonable accordance with the long range facility plan and educational specifications based on the School Facilities Standards as adopted by the Commissioner of Education, November 1, 2021, and as provided by the district. This includes the safety and security directives in section (k) found in the above standard. In addition, certifies that the building has been found to not have any violations by the local authority of jurisdiction or third party code inspector.

CONTRACTOR/CM: **BY:** **DATE:**

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: **BY:** **DATE:**

INSTRUCTIONS FOR COMPLETION OF "CERTIFICATION OF PROJECT COMPLIANCE" FORM

Section 1. Identify the following:
- – name and address of the school facility
- – name of the school district
- – the Architect/Engineer and Contractor
- – the date of execution of the construction contract
- – the date that the school district authorized the superintendent to hire an architect/engineer
- – scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.1040, School Facilities Standards) and returned to the school district's files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district's files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

CLOSE-OUT FORM "C"

SUBCONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

THE STATE OF _____

COUNTY OF _____

PROJECT: Middle School 8

OWNER: Lamar Consolidated Independent School District

ARCHITECT: PBK

SPECIFICATION SECTION(S):

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says that he / she is the _____ of _____,the subcontractor / supplier who constructed or provided the section(s) of work referenced above, and that he / she is duly authorized to certify to the best of his / her information, knowledge, and belief no asbestos, lead or PCB containing products have been incorporated into the project.

ATTEST (If Corporation)

_____
Name of Subcontractor / Supplier

_____ _____

_____ Secretary (By)
(Title)

JURAT

THE STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

_____
(Seal) (Notary Public Signature)

CLOSE-OUT FORM "D"

SUBCONTRACTOR WARRANTY

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the Subcontractor (or the _____of_____ the subcontractor) who supplied, installed, and / or erected the work described below, and that, he / she is duly authorized to make this Subcontractor Warranty:

   Project: Middle School 8
   Owner: Lamar Consolidated Independent School District Architect: PBK
   Work Performed: _____Specification Section(s): _____

2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Subcontractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.

4. The Subcontractor warrants the work performed for a period of _____ months from the date of Substantial Completion, except as follows:_____
   _____

ATTEST (If Corporation)

_____
Name of Subcontractor

_____

Secretary (By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20____.

_____

(Seal) (Notary Public Signature)

DOCUMENT AI - WAIVER AND RELEASE OF LIENS

PART 1 GENERAL

1.1 SUMMARY

A. Document Includes: Applicability and use of statutory Waiver and Release of Lien forms promulgated by the Legislature of the State of Texas for construction projects in Texas.

B. Related Requirements:
   1. The Contract for Construction (also referred to as the Agreement or the Contract)
   2. Conditions of the Contract (General, Supplementary, and other conditions, if any)
   3. Section 01 29 00 Payment Procedures
   4. Section 01 77 00 Contract Closeout
   5. Section 01 77 01 Closeout Procedures

1.2 REFERENCES

A. Texas Property Code, Chapter 53, Subchapter L, Sections 53.281 thru 53.287 (includes the standard forms attached herewith immediately following this section):
   1. Form 1: Conditional Waiver for Progress Payments
   2. Form 2: Unconditional Waiver for Progress Payments
   3. Form 3: Conditional Waiver for Final Payments
   4. Form 4: Unconditional Waiver for Final Payments

PART 2 PRODUCTS *(not used)*

PART 3 EXECUTION

3.1 SELECTION AND USE OF WAIVER AND RELEASE OF LIEN FORMS

A. Based on answers to the following questions, use the applicable form for the occasion:
   1. Is the payment a *progress* payment (partial, not final), or a *final* payment?
   2. Is the release *unconditional* (for a payment already received), or *conditional* (given in anticipation of a payment not yet received)?

B. Submit the applicable form, properly executed (filled out, signed and dated) and notarized, on each occasion required (see other portions of the Contract Documents, including but not necessarily limited to the related requirements documents cited above).

C. The wording of these forms is prescribed by the State of Texas. Questions regarding their use, execution, etc. should be directed to user's own attorney experienced in construction or lien law. This document is not to be interpreted as rendering legal advice.

D. Even if the Contract Documents do not explicitly require submittal of Waivers and Releases of Liens for every payment (for example, omitting them for monthly progress payments), the Owner reserves the right, at its sole discretion, to require applicable Waivers and Releases of Liens, executed and notarized, for any or all payments.

END OF DOCUMENT AI

(see following pages for standard forms)

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of $_____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____ (owner) located at _____ (location) to the following extent: _____ (job description).

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____
_____ (Company name)
By _____ (Signature)
_____ (Printed/Typed name)
_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This _____ day of _____, 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____ PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

The signer of this document has been paid and has received a progress payment in the sum of $_____ for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____ (Owner) located at _____ (location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent:

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____
_____ (Company name)
By _____ (Signature)
_____ (Printed/Typed name)
_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____ PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

On receipt by the signer of this document of a check from _____ (maker of check) in the sum of $_____ payable to _____ (payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of _____ (owner) located at _____ (location) to the following extent: _____ (job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted).

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____
_____ (Company name)
By _____ (Signature)
_____ (Printed/Typed name)
_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____
OWNER'S NAME: _____ PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

The signer of this document has been paid in full for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____ (owner) located at _____ (location) to the following extent: _____ (job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____
_____ (Company name)
By _____ (Signature)
_____ (Printed/Typed name)
_____ (Title)

SWORN AND SUBSCRIBED before me at _____, _____, This ____ day of _____. 20____ A.D.

_____

Notary Public in and for the state of _____

(END OF ATTACHED FORMS)

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for project record documents, including but not limited to:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings:
   1. Number of Copies: Submit one set of marked up record prints.
   2. Number of Copies: Submit copies of record Drawings:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Submit record digital data files and one sets of plots.
         3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit PDF electronic files of scanned record prints and three sets of prints.
         2) Submit record digital data files and three sets of record digital data file plots.
         3) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and one annotated PDF electronic file of the Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and one annotated PDF electronic file and directory of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked up Product Data as a component of manual.

D. Miscellaneous Record Submittals: Refer to the individual Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 PROJECT RECORD DOCUMENT PROCEDURES

A. Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect’s reference.
   1. Do not use As Built Drawings and Specifications for Record Drawings and Specifications.

B. Recording Procedures: Update drawings and specifications on daily bases to record actual conditions. Record information concurrently with construction progress. Do not conceal Work until required information is accurately recorded.

C. Store Record Documents and samples apart from as built documents used for construction.
   1. Label and file Record Documents and samples in accordance with section number listings in Table of Contents. Label each document *PROJECT RECORD* in neat, large, printed letters.
   2. Maintain Record Documents in clean, dry and legible condition.
   3. Make Record Documents and samples available for inspection upon request of Architect.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked up paper copies of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked up record prints. Show actual installation conditions where installation varies from that shown originally.
      a. Give attention to information on concealed elements difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross reference record prints to corresponding shop drawings or archive photographic documentation.

   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Construction Change Directive.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.

   3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked up record prints.
   4. Mark record sets with erasable, red colored pencil. Use colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked up record prints with Architect. When authorized, prepare full set of corrected digital data files of the Contract Drawings:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings and annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
    a. Refer to Section 01 33 00 for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or modification.

2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation *PROJECT RECORD DRAWING* in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
    a. Project name.
    b. Date.
    c. Designation PROJECT RECORD DRAWINGS.
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Indicate actual product installation where installation varies from that indicated in Specifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.

5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and marked up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 RECORD SAMPLES

A. Record Samples: Determine with Architect and Owner which submitted Samples are to be maintained as Record Samples. Maintain and mark one set to indicate date of review and approval by Architect; note any deviations or variations between reviewed sample and installed product or material.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by the individual Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Include the following:
   1. Reviewed shop drawings, product data, and samples.
   2. Field test reports.
   3. Inspection certificates and manufacturer's certificates.
   4. Inspections by authorities having jurisdiction (AHJ).
   5. Documentation of foundation depths.
   6. Special measurements or adjustments.
   7. Tests and inspections.
   8. Surveys.
   9. Design mixes.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked up miscellaneous record submittals. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.
4. O&M Manuals should be uploaded into Owner’s designated software (Prolog)

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:
   a. Name of Project.
   b. Name and address of videographer.
   c. Name of Architect.
   d. Name of Contractor.
   e. Date of video recording.

2. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.

e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish an instructor to describe Owner's operational philosophy.
   2. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

   1. Schedule training with Owner through Program Manager with at least 10 days' advance

notice.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

END OF SECTION 01 79 00

SECTION 03 05 80 - UNDER-SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Products Supplied Under This Section
   1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

B. Related Sections
   1. Section 03 30 00 Cast-in-place Structural Concrete
   2. Section 01 45 23 Structural Testing and Inspection

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM E 1745-97 (2004) Standard Specification for Plastic Water Vapor Barriers Used in Contact with Soil or Granular Fill Under Concrete Slabs
   2. ASTM E 154-88 (2005) Standard Test Methods for Water Vapor Barriers Used in Contact with Earth Under Concrete Slabs
   3. ASTM E 96-95 Standard Test Methods for Water Vapor Transmission of Materials
   4. ASTM E 1643-98 (2005) Standard Practice for Installation of Water Vapor Barriers Used in Contact with Earth or Granular Fill Under Concrete Slabs

B. American Concrete Institute (ACI)
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.4 SUBMITTALS

A. Quality Control / Assurance
   1. Full set of test results as per paragraph 8.3 of ASTM E 1745.
   2. Manufacturer’s samples, literature
   3. Manufacturer’s installation instructions for placement, seaming and pipe boot installation.

1.5 SUBSTITUTIONS

A. Product Review
   1. Request must be made 14 days prior to bid date to allow time for proper review. Reviews will be at contractor’s expense.
   2. Independent laboratory test results showing compliance with ASTM E 1745 Class A, a permeance less than 0.01 Perms (grains/(ft2 *hr * in. Hg) before and after the mandatory

conditioning tests ASTM E 154 Sections 8,11,12, and 13. (Woven, and recycled plastics are not permitted

3. Incomplete substitutions will not be accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Barrier (Performance based specification). When the specifications of different sections conflict, the contractor shall perform to the most restrictive provision. Vapor Barrier membrane must have the following properties.
   1. Permeance as tested after mandatory conditioning (ASTM E 154 sections 8,11,12,13) less than 0.01 Perms [grains/(ft2 *hr. * in. Hg)]
   2. Other performance criteria
      a. Strength: ASTM E 1745 Class A
      b. Thickness: 15 mils minimum

2.2 ACCESSORIES

A. Seam Tape
   1. Tape must have the following qualities:
      a. Water Vapor Transmission Rate ASTM E 96, 0.3 perms or lower
   2. Seam Tape
      a. Manufacturer's standard seam tape.
      b. Stego Crete Claw (for slabs on void boxes).

B. Vapor Proofing Mastic
   1. Mastic must have the following qualities:
      a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower

C. Pipe Boots
   1. Construct pipe boots from Vapor Barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by architect or geotechnical firm
   1. Level and tamp or roll aggregate, sand, or tamped earth base.

3.2 INSTALLATION

A. Install Vapor Barrier:
   1. Installation shall be in accordance with manufacturer's written instructions and ASTM E 1643-09.
      a. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
      b. Lap Vapor Barrier over footings or seal to foundation walls.
      c. Overlap joints 6 inches and seal with manufacturer's tape.

d. Seal all penetrations (including pipes) per manufacturer's instructions.
e. No penetration of the Vapor Barrier is allowed except for reinforcing steel and permanent utilities.
f. Repair damaged areas by cutting patches of Vapor Barrier, overlapping damaged area 6 inches, and taping all four sides with tape.

END OF SECTION 03 05 80

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete formwork, for the following:
   1. Footings and/or piers.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Testing and Inspection Services”.
   2. Section 03 33 00 "Architectural Concrete".
   3. Section 03 30 00 “Cast In Place Concrete”.
   4. Section 03 20 00 “Concrete Reinforcing”.
   5. Section 03 47 13 “Tilt Up Concrete”.
   6. Section 03 38 16 “Unbonded Post Tensioned Concrete”.
   7. Section 03 53 00 "Concrete Topping".

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. American Concrete Institute (ACI):
      a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
      b. ACI 301 – Specifications for Structural Concrete for Buildings
      c. ACI 318 – Building Code Requirements for Structural Concrete
      d. ACI 347 – Guide to Formwork for Concrete
      e. ACI SP-4 – Formwork for Concrete.

1.4 PERFORMANCE REQUIREMENTS

A. Design and engineering of formwork, including shores, reshores, false work, bracing, and other temporary supports as well as determining when temporary supports and bracing can safely be removed after the specified curing time is the Contractor’s responsibility.

B. All components of the formwork shall be designed to support all loads imposed during construction including weight of construction equipment, live loads, and lateral loads due to wind and imbalance or discontinuity of building components.

C. If any post tensioned members exist on the project, the formwork supporting those elements shall:
   1. It is essential to take into account the stressing sequence of post-tensioned concrete in the design of the formwork. Any concrete element which is stressed can transfer its weight off the form work to the supporting concrete element in which case the forms for the supporting concrete element must be designed to support the entire load tributary of that element.
   2. Forms shall be designed and constructed to permit movement during stressing, both lifting and shortening of the concrete elements.
   3. Formwork supporting beams and girders shall be designed to support the weight of the beam or girder's entire tributary area.
   4. Formwork supporting post tensioned concrete elements shall not be removed until all concrete supported by the formwork has been fully stressed, but in no case shall the curing time before form removal be less than specified herein.
   5. Design, engineering, and production of shop drawings for the form work shall be performed under the supervision of a professional engineer.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Shop drawings for layout of pan type forms, if they exist on the project. Layout only - information and details about the support of these forms is not required, as it is the responsibility of the Contractor and his registered engineer
   1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

C. Manufacturer's product data and installation instruction for propriety materials used in exposed concrete work including form liners, release agents, form systems, ties, and accessories.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver form materials in manufacturer's packaging with installation instructions.

B. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician. An experienced installer who has completed work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

B. Testing Agency Qualifications: Refer to Section 01 45 23.

C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Permanent Metal Forms for Slabs: Deck material, gauge and rib pattern shall be as noted on Drawings.

E. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
1. Pans shall be free of dents, irregularities, sag, rust or other deterioration.
2. In areas permanently exposed to view, provide one piece units, manufactured to length between beams or ribs, or segmented units with reinforced butt-joint splices.

F. Load-bearing Rigid Board Insulating Fill Under Slabs:
1. Extruded Polystyrene Board Insulation: Comply with ASTM C 578, Type X, 15 psi minimum compressive strength, 1.30 lb./cu. ft. (21 kg/cu. m) .

a. Owens Corning Insulating Systems, LLC, Toledo, OH 43659; www.owenscorning.com.
b. Thermal Resistance: (180-day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F): R-5.0 per inch of thickness, with 90% lifetime limited warranty on thermal resistance.
c. Blowing Agent Formulation: Zero ozone depleting.
d. Install according to manufacturer's recommended instructions.

2. Expanded Polystyrene Board Insulation: Un-faced Flat Board Stock: Rigid, closed cell, expanded polystyrene (EPS) boards, UL certified, complying with ASTM C 578 Type VIII, 15 psi minimum compressive strength .
a. Insulfoam, a Carlisle Company, which is located at: 6004 N. Westgate Blvd. Suite 120 ; Tacoma, WA 98406; Toll Free Tel: 800-248-5995; Tel: 253-572-5111; Email: request info (info@insulfoam.com); Web: www.insulfoam.com
b. Blowing Agent Formulation: Zero ozone depleting.
c. Install according to manufacturer's recommended instructions.

G. Formwork Accessories
1. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
2. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
3. Expansion-Contraction Joint Filler Material: Bonded fabric of thickness indicated on Drawings composed of cellular fibers securely bonded together and uniformly saturated with asphalt complying with ASTM D 1751.
4. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
a. Formulate form-release agent with rust inhibitor for steel form-facing materials.
5. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
a. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
b. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
c. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.

2. Class B, 1/4 inch
3. Class C, 1/2 inch
4. Class D, 1 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts that are attached to the formwork.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

4. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
   3. Determine compressive strength of in place concrete by testing representative field-cured test specimens according to ACI 301.

B. Obtaining concrete compressive strength tests for the purposes of form removal shall be the responsibility of the Contractor.

C. In the absence of cylinder tests, formwork shall remain in place until the concrete has cured at a temperature of at least 50 degrees Fahrenheit (10 degrees Celsius) for the minimum cumulative time periods given in ACI 347, Section 3.7.2.3. When the surrounding air temperature is below 50 degrees Fahrenheit (10 degrees Celsius), that time period shall be added to the minimum listed time period.

D. Formwork for two-way conventionally reinforced slabs shall remain in place for at least the minimum cumulative time periods specified for one-way slabs of the same maximum span. Two-way conventionally reinforced slabs shall then be reshored until they attain the specified 28 day strength.

E. Minimum cumulative curing times may be reduced by the use of high-early strength cement or forming systems that allow form removal without displacing shores. However, the Contractor must demonstrate, to the satisfaction of the Architect, that the early removal of forms will not result in excessive sag, distortion or damage to the concrete elements.

F. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

G. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. The Contractor shall be solely responsible for proper shoring and reshoring. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

C. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement. Reshores shall be located in the same position on each floor. No construction loads shall be placed on the new construction until all supporting reshores have been installed.
   1. Extend shores or reshores from ground to top level in structure three stories or less in height, unless noted otherwise.
   2. In structures over three stories in height, extend shores or reshores at least three levels under the level being placed. Extend shores beyond the minimum number of levels if required to ensure proper distribution of loads throughout the structure.
   3. In crawl spaces or basement, shores or reshores shall extend to mud pads seated firmly on the soil or to on grade construction.

D. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

E. Bottom tier of reshores shall remain in place until the supported concrete has attained at least 85 percent of the specified 28-day compressive strength and construction loads in excess of 20 psf have been removed but not less than 14 days.

3.5 REUSE OF FORMS

A. Clean and repair surfaces of forms to be used in the Work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form release agent.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Otherwise, locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are to be installed.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform

color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces indicated or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated or to receive trowel finish or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment

END OF SECTION 03 10 00

SECTION 03 11 31 - VOID FORMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes corrugated paper void form material to create a temporary support for the placement of structural concrete slabs, grade beams, or walls over expansive soils.

B. Related Sections:
1. Section 01 45 23 “Testing and Inspection Services”.
2. Section 03 33 00 "Architectural Concrete".
3. Section 03 30 00 “Cast In Place Concrete”.
4. Section 03 20 00 “Concrete Reinforcing”.
5. Section 03 47 13 “Tilt Up Concrete”.
6. Section 03 38 16 “Unbonded Post Tensioned Concrete”.

1.3 PERFORMANCE REQUIREMENTS

A. All components of the formwork shall be designed to support all loads imposed during construction including weight of construction equipment, live loads, and lateral loads due to wind and imbalance or discontinuity of building components.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated including manufacturer’s written installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver form materials in manufacturer’s packaging with installation instructions.

B. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.

1.6 QUALITY ASSURANCE

A. Design, place, and maintain void forms or carton forms for cast in place concrete work in compliance with ACI 347 “Guide to Form Work” unless otherwise shown or specified.

B. Testing Agency Qualifications: Refer Section 01 45 23.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads, but not less than 800 pounds per square foot. Interior components shall be constructs as shown below:
   1. Extra Fast Decomposition – Non wax impregnated, plain kraft paper and a water soluble adhesive.
   2. Fast Decomposition – Non wax impregnated, plain kraft paper and a moisture resistant adhesive.
   3. Moderate Decomposition – Plain kraft paper with a wax impregnated medium, but non wax impregnated liners and a moisture resistant adhesive.
   4. Slow Decomposition – Plain kraft paper with wax impregnated medium / liners and a moisture resistant adhesive.
   5. Extra Slow Decomposition – Wet strength paper with wax impregnated medium / liners and a moisture resistant adhesive.

2.2 VOID BOXES

A. Slabs: Use “Slab Void” with interior cell sizes 8”x8” or smaller, capable of sustaining a working load 800 psf, for slabs 8 inches thick or less. For slabs between 8 inches thick and 12 inches thick, void box shall be capable of sustaining a working load of 1000 psf. For slabs greater than 12 inches thick, consult with the structural engineer. For interior piers, provide pre-manufactured curved end units against top of piers for tight fit.

B. Grade beams and walls: Rectangular shape as shown on plans. Trapezoidal void boxes are not acceptable. Provide end caps at ends of forms and corners. Provide pre-manufactured curved end units against top of piers for tight fit. Cartons shall be capable of sustaining a working load of 200 psf times the height of the pour (in feet), without significant deformation.

C. Design and maintain void forms to maintain all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. This includes, but is not limited to, live load, dead load, and weight of moving equipment, height of concrete drop, vibrator frequency, ambient temperature, soil pressures, and lateral stability.

D. Form material shall be designed to lose it strength upon prolonged contact with the moisture that normally accumulates beneath slabs and beams on grade. Sufficient deterioration to cushion uplift forces shall take place within a maximum of 8 weeks after placement of concrete.

2.3 RELATED PRODUCTS

A. Protection Board: Used over carton forms under slabs and under grade beam or walls wider than 12 inches. 1/4-inch minimum hardboard.

B. Soil Retainers: High density, polyethylene (HDPE). “Sure Retainer” by Motzblock or ½ inch thick “Backfill Retainer” by Sure Void Products. Retainers shall be sized such that they extend a minimum of 4 inches above the void box and 4 inches below the void box.

PART 3 - EXECUTION

3.1 CARTON FORMS

A. A void shall be constructed below all structural elements supported by piers to separate these elements from the soil. Where carton forms are used to construct this void the construction shall comply with the following:
   1. Seal discontinuous ends of carton forms and tape all joints with waterproof tape so that concrete will not enter the void space during placement of concrete. Do not leave gaps between carton form sections.
   2. Pre-manufactured carton forms with circular edges shall be used around all drilled piers. Cutting of square carton forms is not acceptable.
   3. Do not allow any portion of carton forms to fall within the circumference of piers causing reduction in bearing area.
   4. Protect carton forms from water. Do not install carton forms during wet weather or on wet ground. Carton forms which become wet prior to placement of concrete shall be removed and replaced.
   5. Protect carton forms, from puncturing, collapsing, or crushing during construction. All damaged carton forms must be replaced prior to concrete placement.
   6. Exercise care in placement of concrete to avoid collapse of carton forms. If carton forms collapse, soil beneath the concrete shall be dug out and a proper void space shall be created and protected by installing the specified soil retainers.
   7. Carton forms wrapped in plastic to protect them from water, shall have the plastic ripped or punctured immediately prior to concrete placement.

B. Carton Forms Under Slabs
   1. Carton forms under slabs shall be protected on top by a protection board as specified with the specified vapor retarder on top of the protection board.
   2. Carton forms shall not be placed under soil supported slabs on grade.

END OF SECTION 03 11 31

SECTION 03 15 13 - WATERSTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Provision of waterstops embedded in concrete and spanning control, expansion, and/or construction joints to create a continuous diaphragm to prevent fluid migration.

B. Non-metallic waterstops for use in concrete joints subjected to chlorinated water, sea water, and many waterborne chemicals.

C. Non-metallic waterstops for use in concrete joints subjected to acids, bases, alcohols, oils, solvents, or other chemicals.

1.3 REFERENCES

A. PVC WATERSTOP
   1. Corps of Engineers: CRD-C 572-74
   2. American Society for Testing Materials (ASTM)
   3. Bureau of Reclamation: C-902
   4. Canadian General Standards Board: 41-GP-35M Types 1 & 3
   5. ACI 350.2: Concrete Structures for Containment of Hazardous Materials

B. HYDROPHILIC WATERSTOP
   1. American Society for Testing Materials (ASTM)

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store waterstops under tarps to protect from oil, dirt, sunlight, and premature exposure to water.

1.5 SUBMITTALS

A. Submit shop drawings and fabrication drawings indicating placement of waterstops and shop fabrications.

B. Submit manufacturer’s test data for chemical resistance.

PART 2 - PRODUCTS

2.1 PVC WATERSTOPS FOR EXPANSION JOINTS

A. Provide flexible PVC (polyvinyl chloride) waterstop as manufactured by Greenstreak or approved equal.

B. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.

C. Profile: Ribbed with center bulb.

D. Dimensions: 6 inches by 3/8 inch thick.

E. Performance Requirements as follows:

Property	**Test Method**	**Required Limits**
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/in (35 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35o F
Stiffness in Flexure	ASTM D 747	600 psi min.
Specific Gravity	ASTM D 792	1.45 max.
Hardness, Shore A	ASTM D 2240	79 +3
Tensile Strength after accelerated extraction	CRD-C 572	1850 psi min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalis after 7 days: Weight Change Hardness Change	CRD-C 572	 between -0.10% / +0.25% +/- 5 points

2.2 CHEMICALLY RESISTANT FLEXIBLE WATERSTOP

A. Thermoplastic elastomeric rubber waterstops resistant to oil, solvents, and chemicals as manufactured by Westec or approved equal.

B. Chemical resistance testing to be performed by independent ASTM certified laboratory.

C. Profile: Ribbed with center bulb

D. Dimensions: 6 inches by 3/8 inch thick.

E. Performance requirements as follows:

Property	**Test Method**	**Unexposed Value**
Tensile Strength	ASTM D638	2000 psi
Ultimate Elongation	ASTM D638	450%
100% Modulus	ASTM D638	1000 psi
Shore A Hardness	ASTM D2240	85 units
Low Temp Brittleness	ASTM D746	No Failure @ -70 F

F. Waterstop material should show less than +/- 30% change in material properties, including weight gain after 7-day exposure to selected chemicals, per ASTM D 471 testing.

2.3 HYDROPHILIC WATERSTOP FOR NON-MOVING CONTRACTION AND CONSTRUCTION JOINTS

A. Provide hydrophilic rubber waterstop as supplied by Greenstreak, HYDROTITE profile style number (fill in profile style number).

B. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.

C. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.

D. Performance Requirements as follows:

Chloroprene Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	1300 PSI min.
Ultimate Elongation	ASTM D 412	400% min.
Hardness (Shore A)	ASTM D 2240	50 +/- 5
Tear Resistance	ASTM D 624	100 lb/inch min.

Modified Chloroprene (Hydrophilic) Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	350 PSI min.
Ultimate Elongation	ASTM D 412	600% min.
Hardness (Shore A)	ASTM D 2240	52 +/- 5
Tear Resistance	ASTM D 624	50 lb/inch
Expansion Ratio	Volumetric Change - Distilled Water @ 70o F	3 to 1 min.

2.4 ACCESSORIES

A. PVC and Chemically Resistant Waterstops
1. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.
2. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
3. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.
4. Splices to be free from defects.

B. Hydrophilic Waterstops
1. Provide Greenstreak 7300 two component epoxy gel to secure HYDROTITE to rough, wet (or dry) concrete.

2. Provide LEAKMASTER single component hydrophilic sealant to secure HYDROTITE to rough, dry concrete.
3. Provide cyanacrylate adhesive (super glue) for all splices.
4. Provide LEAKMASTER as addition to cyanacrylate adhesive at all splices for added insurance (Optional).

PART 3 - EXECUTION

3.1 INSTALLATION

A. PVC and Chemically Resistant Waterstops
1. Field butt splices shall be heat fused welded using a Teflon covered thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer recommendations.
2. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
3. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12” on centers along the length of the waterstop and wire tie to adjacent reinforcing steel.
4. Install in longest lengths practicable.
5. Ensure steel reinforcing bars do not interfere with proper position of waterstop.
6. Clean concrete joints of dirt and construction debris prior to second pour of concrete.
7. Cut waterstop ends with miter guide and circular saw to ensure good, full contact at joints.
8. At expansion joints, keep center bulb unembedded at joint centerline.

B. Hydrophilic Waterstop
1. Cut coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
2. Splices shall be sealed using cyanoacrylate adhesive (super glue) and LEAKMASTER (LEAKMASTER is optional).
3. Seal watertight any exposed cells of HYDROTITE using LEAKMASTER.
4. Follow approved manufacturer written recommendations.
5. Install in longest length practicable.

C. Hydrophilic and PVC Intersections
1. Maintain continuity of waterstops at all intersections and transitions.
2. Joinery between PVC and HYDROTITE shall be sealed using LEAKMASTER.
3. Follow approved manufacturer written recommendations.

D. Retrofit Waterstop
1. Prepare existing concrete by grinding away irregularities. Clean concrete to ensure good epoxy bond.
2. Apply continuous bed of epoxy to concrete 1/8 inch thick.
3. Embed retrofit waterstop in uncured epoxy.
4. Mechanically fasten waterstop to concrete using stainless steel batten bars and anchor bolts staggered 6 inches OC max. Use batten bars on top and bottom.
5. Tool continuous layer of epoxy over batten bars and bolts to protect from corrosion.
6. Use expansion joint filler at moving joints to minimize shear stresses.

E. Concrete Placement at Waterstop
   1. Carefully place concrete without displacing waterstop from proper position.
   2. Thoroughly and systematically vibrate concrete around waterstop to obtain impervious, void free concrete in vicinity of joint and to maximize intimate contact between concrete and waterstop.
   3. After first pour, clean un-embedded waterstop leg to ensure full contact of second pour concrete.

END OF SECTION 03 15 13

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete reinforcement, for the following:
   1. Footings and/or piers.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Testing and Inspection Services”.
   2. Section 03 10 00 “Concrete Forming and Accessories”.
   3. Section 03 30 00 “Cast In Place Concrete”.
   4. Section 03 47 13 “Tilt Up Concrete”.
   5. Section 03 38 16 “Unbonded Post Tensioned Concrete”.
   6. Section 04 22 00 “Concrete Unit Masonry”.
   7. Section 31 20 00 "Earth Moving".
   8. Section 31 63 29 "Drilled Concrete Piers".

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. American Concrete Institute (ACI)
      a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
      b. ACI 301 – Specifications for Structural Concrete for Buildings
      c. ACI 315 – Details and Detailing of Concrete Reinforcement
      d. SP-66 ACI Detailing Manual
   2. American Welding Society (AWS)
      a. AWS D1.1 – Structural Welding Code
   3. Concrete Reinforcing Steel Institute (CRSI)
      a. CRSI – Manual of Standard Practice
      b. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
      c. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.
   4. American Society of Testing Materials (ASTM)

a. ASTM-A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.
b. ASTM-A663: Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
c. ASTM-A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
d. ASTM-A675: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
e. ASTM-A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
f. ASTM-A775: Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
g. ASTM-A884: Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.

B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement, according to ACI 315 “Details and Detailing of Concrete Reinforcement.”
1. Do not reproduce the structural drawings for use as shop drawings.

C. Bar Supports: Submit manufacturer’s product information for bolsters, chairs, spaces, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency, installer, and fabricator as indicated herein.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
1. Steel reinforcement and accessories.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Installer Qualifications: An experienced installer who has completed reinforcing installation work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

C. Fabricator Qualifications: An experienced fabricator who has completed reinforcing fabrication work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4, "Structural Welding Code - Reinforcing Steel."

E. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615, Grade 60 or Grade 75 as indicated on Drawings, deformed.

C. Low-Alloy-Steel Reinforcing Bars for bars to be welded: ASTM A 706, Grade 60 for #6 and smaller bars, Grade 75 for #7 and larger bars, deformed.

D. Add the following paragraph below for stainless-steel reinforcement. Retain one of two options for reinforcement type.

E. Stainless-Steel Reinforcing Bars: ASTM A 955, Grade 60, [Type 304] [Type 316L], deformed.

F. Steel Bar Mats: ASTM A 184, fabricated from ASTM A 615, Grade 60 or ASTM A 706, deformed bars, assembled with clips.

G. Plain-Steel Wire: ASTM A 82, as drawn.

H. Deformed-Steel Wire: ASTM A 496.

I. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

J. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, or other unacceptable materials.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice." Combined tolerances for formwork, reinforcing fabrication, and reinforcing placement shall not permit a reduction in specified concrete cover of reinforcing steel. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken material. Bars used for concrete reinforcement shall meet following requirements for fabricating tolerances:
   1. Sheared length: Plus or minus 1 inch.
   2. Depth of truss bars: Plus 0, minus ½ inch.
   3. Overall dimensions of stirrups, ties, and spirals: Plus or minus ½ inch.
   4. Other bends: Plus or minus 1 inch.

B. For bars with end bearing splice couplers, bar ends shall terminate in flat surfaces, within 1.5 degrees of a right angle to axis of bars and shall be fitted within 3 degrees of full bearing after assembly.

2.4 DOWEL BAR ANCHORS/SPLICERS

A. Provide dowel bar anchors and threaded dowels designed to develop, both in tension and compression, 125% of the minimum ASTM specified yield strength of the dowel bars, as evidenced by published I.C.B.O. test reports. Unless otherwise indicated, anchors shall be furnished with ACI standard 90 degree hooks. Dowels shall be furnished by anchor supplier. The following dowel splicing systems are acceptable.
   1. Richmond Screw Anchor “Dowel Bar Splicer”
   2. Erico “Lenton Form Saver”
   3. Dayton Barsplice “Grip-Twist”

2.5 MECHANICAL SPLICES

A. A. Provide mechanical splices designed to develop, both in tension and compression, 125% of minimum ASTM yield strength of the smaller bar being coupled, as evidenced by published I.C.B.O test reports. The following bar splicing systems are acceptable.
   1. Erico “Cadweld C-Series”
   2. Erico “Lenton”
   3. Dayton Barsplice “Bar Grip”

4. Dayton Barsplice “Grip Twist”

2.6 METAL ANCHORAGE AND EMBEDDED METAL ASSEMBLIES

A. Steel Shapes and Plates: Conform to ASTM A36, “Specification for Structural Steel”.

B. Headed Stud Anchors: Headed studs welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

C. Welding Electrodes: AWS 5.5, Series E70.

D. Welded Deformed Bar Anchors: Welded by full fusion process, as furnished by TRW Nelson Stud Welding Division.

E. All metal assemblies exposed to earth, weather, or moisture, including exposure to a crawl space environment, shall be hot dip galvanized.

2.7 FABRICATION OF METAL ACCESSORIES AND EMBEDDED METAL ASSEMBLIES

A. Fabricate and assemble structural steel items in the shop. Shearing, flame cutting, and chipping shall be done carefully and accurately. Holes shall be cut, drilled, or punched at right angles to the surface of metal and shall not be made or enlarged by burning. Holes shall be clean-cut without torn or ragged edges. Welded construction shall conform to AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings,” and AWS D1.1. Welding shall be done by AWS certified welders.

B. Welding of deformed bar anchors and headed stud anchors shall be done by full fusion process equal to that of TRW Nelson Stud Welding Division of KSM Welding Services Division, Omark, Ind. A minimum of two headed studs shall be tested at start of each production period for proper quality control. Studs shall be capable of being bent 45 degrees without weld failure.

C. Welding of reinforcement shall be done in strict accordance with AWS requirements, using recommended preheat temperature and electrode for type of reinforcement being welded. Bars larger than No. 9 shall not be welded. Welding shall be performed subject to the observance and testing laboratory. Under no circumstances is ordinary reinforcing (ASTM A615) to be welded.

D. Coatings, where required, shall be applied after fabrication and prior to casting concrete.

PART 3 - EXECUTION

3.1 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.2 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Provide minimum concrete covering for reinforcement as shown in the Structural General Notes.
G. Place bars to following tolerances:
1. Clear distance to formed surfaces: Plus or minus 1/4 inch.
2. Minimum spacing between bars: Minus 1/4 inch.
3. Top bars in slabs and beams:
a. Members 8 inches deep or less: Plus or minus 1/4 inch.
b. Members between 8 and 24 inches deep: Plus or minus 1/2 inch.
c. Members more than 24 inches deep: Plus or minus 1 inch.

4. Crosswise of members: Spaced evenly within 2 inches.
5. Length of members: Plus or minus 2 inches.

H. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.

I. Support reinforcement and fasten together to prevent displacement by construction loads or placing concrete beyond tolerances indicated.

J. Unless permitted by Engineer, do not bend reinforcement after embedding in hardened concrete.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.

B. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Concrete toppings.
   6. Building frame members.
   7. Building walls.

B. Related Sections:
   1. Section 01 45 23 “Structural Testing and Inspection Services”.
   2. Section 03 20 00 "Concrete Forming and Accessories".
   3. Section 03 10 00 "Concrete Reinforcing".
   4. Section 03 11 31 “Void Forms”.
   5. Section 03 15 13 “Waterstops”.
   6. Section 03 05 80 “Under-slab Vapor Barrier – Retarder”.
   7. Section 03 47 13 “Tilt Up Concrete”.
   8. Section 31 63 29 “Drilled Concrete Piers and Shafts”.

1.3 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
   1. ACI 301 – Specification for Structural Concrete.
   2. ACI 302 – Guide for Concrete Floor Slab Construction.
   3. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
   4. ACI 305 – Hot Weather Concreting.
   5. ACI 306 – Cold Weather Concreting.
   6. ACI 308 – Guide to Curing Concrete.
   7. ACI 309 – Guide for Consolidating Concrete.
   8. ACI 311 – ACI Manual for Concrete Inspection.
   9. ACI 318 – Building Code Requirements for Reinforced Concrete.
   10. ACI 347 – Guide to Concrete Formwork.
   11. ACI 207 – Mass Concrete.
   12. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

13. ACI 211.2 – Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
14. ACI 212.3 – Chemical Admixture for Concrete.
15. ACI 212.4 – Guide for the use of High Range Water Reducing Admixtures in Concrete.
16. ACI 214 – Evaluation of Strength Test Results of Concrete.
17. ACI 303 – Guide to Cast in Place Architectural Concrete Practice.
18. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”.

B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture include the following information. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Each proposed mix design shall be accompanied by a complete standard deviation analysis based on at least 30 consecutive strength tests, or by three laboratory trial mixtures with confirmation tests.
2. Proportions of cement, fine, and coarse aggregate, and water.
3. Design strength.
4. Maximum slump.
5. Air Content.
6. Maximum water / cement ratio.
7. Maximum and minimum concrete temperature that is acceptable at time of placement for which the manufacturer can guarantee the strength of the concrete.
8. Type cement and aggregates.
9. Type and quantities of all admixtures.
10. Air dry density and splitting tensile strength for lightweight concrete determined in accordance with ASTM 330.
11. Type, color, and quantities of integral coloring compounds, where applicable.
12. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Refer Section 03 20 00.

D. Formwork Shop Drawings: Refer Section 03 10 00.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Semi rigid joint filler.
9. Joint-filler strips.
10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: See Section 01 45 23.
1. Contractor’s responsibility to testing laboratory.
a. Furnish all labor and materials as required to assist testing agency in obtaining, making and handling samples at the jobsite.
b. Advise the Owner’s Testing Laboratory sufficiently in advance of operations to allow adequate time for the assignment of testing personnel.
c. Furnish and maintain adequate facilities for proper curing of concrete test specimens on the project site in accordance with ASTM C31.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
   1. Build panel approximately 200 sq. ft. for slab-on-grade and 100 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by Architect.

H. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings, if any, on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. See Section 03 10 00.

2.2 STEEL REINFORCEMENT

A. See Section 03 20 00.

2.3 REINFORCEMENT ACCESSORIES

A. See Section 03 20 00.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I or Type I/II, gray. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C. Carbon content shall not exceed 3 percent by volume.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years of satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches, 1 inch, or 3/4 inch nominal as indicated on Drawings for specific uses.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that contain not more than 0.05 percent water soluble chloride ions. Do not use calcium chloride or admixtures containing calcium chloride (except the chemical admixture Xypex).
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
   7. Waterproofing Admixture: Xypex Admix C-1000

C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ChemMasters.
      b. Davis Colors.
      c. Dayton Superior Corporation.
      d. Hoover Color Corporation.
      e. Lambert Corporation.
      f. QC Construction Products.
      g. Rockwood Pigments NA, Inc.
      h. Scofield, L. M. Company.

i. Solomon Colors, Inc.

2. Color: As selected by Architect from manufacturer's full range.

2.6 FIBER REINFORCEMENT

A. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1 to 2-1/4 inches long.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. 3M; Scotchcast Polyolefin Fibers 2".
   b. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
   c. FORTA Corporation; FORTA FERRO.
   d. Grace Construction Products, W. R. Grace & Co.; Strux 90/40.
   e. Nycon, Inc.; XL.
   f. Propex Concrete Systems Corp.; Fibermesh 650.
   g. Sika Corporation; Sika Fiber MS or MS10.

2.7 CONCRETE MIX DESIGNS

A. Selection of Proportions: Proportions of ingredients for concrete mixes shall be determined by a qualified concrete supplier in accordance with the requirements of ACI 301.

B. Required average strength above specified strength: Determination of required average strength above specified strength shall be based on the standard deviation record of the production facility in accordance with ACI 301. Calculation of standard deviation of compressive strength results shall be made in accordance with ACI 214. If a suitable record of strength tests is not available, proportions shall be selected on the basis of laboratory trial batches to produce an average strength greater than the strength f'c by the amount defined in ACI 301.

2.8 VAPOR RETARDERS

A. See Section 03 05 80.

2.9 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 sieve.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Anti-Hydro International, Inc.; Emery.
   b. Dayton Superior Corporation; Emery Tuff Non-Slip.
   c. Lambert Corporation; EMAG-20.
   d. L&M Construction Chemicals, Inc.; Grip It.
   e. Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Anti-Hydro International, Inc.; A-H Alox.
   b. L&M Construction Chemicals, Inc.; Grip It AO.

c. Master Builders Solutions; MasterTop 120SR (Pre-2014: Frictex NS)

2.10 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. ChemMasters; Chemisil Plus.
   b. ChemTec Int'l; ChemTec One.
   c. Conspec by Dayton Superior; Intraseal.
   d. Curecrete Distribution Inc.; Ashford Formula.
   e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
   f. Edoco by Dayton Superior; Titan Hard.
   g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
   h. Kaufman Products, Inc.; SureHard.
   i. L&M Construction Chemicals, Inc.; Seal Hard.
   j. Meadows, W. R., Inc.; LIQUI-HARD.
   k. Metalcrete Industries; Floorsaver.
   l. Nox-Crete Products Group; Duro-Nox.
   m. Symons by Dayton Superior; Buff Hard.
   n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
   o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Advanced Floor Products; Retro-Plate 99.
   b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
   c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
   b. ChemMasters; SprayFilm.
   c. Conspec by Dayton Superior; Aquafilm.
   d. Dayton Superior Corporation; Sure Film (J-74).
   e. Edoco by Dayton Superior; BurkeFilm.
   f. Euclid Chemical Company (The), an RPM company; Eucobar.
   g. Kaufman Products, Inc.; Vapor-Aid.
   h. Lambert Corporation; LAMBCO Skin.

i. L&M Construction Chemicals, Inc.; E-CON.
j. Master Builders Solutions; MasterKure ER 50 (Pre-2014: Conflim).
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior; W.B. Resin Cure.
d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
e. Edoco by Dayton Superior; Res X Cure WB.
f. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; AQUA KURE - CLEAR.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100-CLEAR.
k. Nox-Crete Products Group; Resin Cure E.
l. Right Pointe; Clear Water Resin.
m. SpecChem, LLC; Spec Rez Clear.
n. Symons by Dayton Superior; Resi-Chem Clear.
o. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ChemMasters; Polyseal WB.
b. Conspec by Dayton Superior; Sealcure 1315 WB.
c. Edoco by Dayton Superior; Cureseal 1315 WB.
d. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.

f. Lambert Corporation; UV Safe Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
h. Master Builders Solutions; MasterKure CC 1315WB (Pre 2014: Kure1315).
i. Meadows, W. R., Inc.; Vocomp-30.
j. Metalcrete Industries; Metcure 30.
k. Right Pointe; Right Sheen WB30.
l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.12 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.14 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, as indicated in Structural General Notes.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.15 NON-SHRINK GROUT

A. Grout shall be prepackaged, non metallic, and non gaseous. It shall be non-shrink when tested in accordance with ASTM-C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees to 90 degrees Fahrenheit. Grout shall be bleed free and attain 7,500 psi compressive strength in 28 days at fluid consistency. Certified independent test data required. Approved products include the following:
   1. “Euco NS” by Euclid Chemical Company
   2. “Masterflow 713” by Master Builders.

2.16 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as indicated in Structural General Notes:

2.17 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.18 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. See Section 03 10 00.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. See Section 03 10 00.

3.4 SHORES AND RESHORES

A. See Section 03 10 00.

3.5 VAPOR RETARDERS/BARRIERS

A. See Section 03 05 80.

3.6 STEEL REINFORCEMENT

A. See Section 03 20 00

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are specified or otherwise indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Do not permit concrete to drop freely any distance greater than 10’-0” for concrete containing a high range water reducing admixture or 5’-0” for other concrete. Provide chute or tremie to place concrete where longer drops are necessary. Do not place concrete into excavations with standing water. If place of deposit cannot be pumped dry, pour concrete through a tremie with its outlet near the bottom of the place of deposit.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

H. Hot-Weather Placement: Comply with ACI 305 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. See Section 03 10 00.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated and/or to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated and/or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated and/or exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces according to ASTM E 1155, for a randomly trafficked floor surface.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
   1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive granules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
   2. After broadcasting and tamping, apply float finish.
   3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive granules.

3.11 CONCRETE FLOOR FINISH TOLERANCES

A. Interior Finish Floor surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." The following values apply before removal of shores. Levelness values F(L) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.
   1. Exposed, vinyl tiled, or thin-set tiled floors: Specified overall values of flatness, Ff =35; and levelness, Fl =25; with minimum local values of flatness, Ff =24; and levelness, Fl =17.
   2. Carpeted floors, floors under concrete toppings, thickset tile and terrazzo: Specified overall values of flatness, Ff =25; and levelness, Fl = 20; with minimum local values of flatness, Ff =17; and levelness, Fl =15.

B. Floor Elevation Tolerance Envelope:
   1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:
      a. Slab-on-Grade, or Slab-on-Void Construction: +/- 3/4"
      b. Top surfaces of formed slabs measured prior to removal of supporting shores: +/- 3/4"
      c. Top surfaces of all other slabs: +/- 3/4"
      d. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10'-0" at any point, up to 3/4" from theoretical elevation at any point.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-

place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer’s written instructions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than 28 days' old.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
   1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
   2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
   3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
   4. Control and dispose of waste products produced by grinding and polishing operations.
   5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's

written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: See Section 01 45 23.
1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
2. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
NOTE: Add articles for flowable fill in products and execution. NEEDS RESEARCH.

END OF SECTION 03 30 00

SECTION 03 30 10 - LANDSCAPE CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 **RELATED DOCUMENTS:** The Drawings, Division 0 and Division 1 apply to work under this Section.

1.2 SUMMARY:

A. Work Included: The work includes, but is not necessarily limited to:

Concrete Seat walls
Concrete Walls
Concrete Stairs and Steps

1.3 QUALITY ASSURANCE:

A. Requirements of Regulatory Agencies:
1. Perform work in accordance with all applicable laws, codes and regulations required by City of College Station, Texas.

B. Reference Standards:
1. American Concrete Institute (ACI):

211.1-77	Recommended Practice for Selecting Proportions for Normal Weight Concrete.
214-77	Recommended Practice for Evaluation of Compressive Test Results of Field Concrete.
305-73	Recommended Practice for Hot Weather Concreting.
306-66	Recommended Practice for Cold Weather Concreting.
347-68	Recommended Practice for Concrete Formwork.

2. American Society for Testing and Materials (ASTM):

A-82-76	Cold Drawn Steel Wire for Concrete Reinforcement.
A185-73	Welded Steel Wire Fabric for Concrete Reinforcement.
A615-78	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
C33-78	Concrete Aggregates.

C94-78	Ready Mixed Concrete.
C150-78a	Portland Cement.
C260-77	Air Entraining Admixtures.
C330-77	Lightweight Aggregates for Structural Concrete.
C494-79	Chemical Admixtures for Concrete.
D1751-73	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and resilient Bitumens Type).

3. Concrete Reinforcing Steel Institute (CRSI):

Manual of Standard Practice.

Recommended Practice for Placing Reinforcing Bars.

C. Testing Laboratory Services

1. Perform all required tests and coordinate all efforts with the designated testing laboratory.
2. Cooperate with testing laboratories to permit proper testing and inspection procedures.

1.4 SUBMITTALS:

A. Forms: Submit Data with complete illustrations and/or descriptions for the following:

1. Inserts, anchors, sleeves and other embedded items.
2. Expansion joint fillers.

B. Cast-In-Place Concrete:

1. Mix Designs for Exposed Concrete: (Refer to Section 32 1314 for concrete mix design components/mix for all exposed concrete)

a. Prepare individual concrete mix designs for:

Each different required concrete strength class.

Each different type aggregate.

Each different admixture to be used.

b. If mix designs are based upon field experience with materials to be used, submit substantiating data at time of submitting mix designs. If suitable field performance data cannot be provided, submit laboratory

confirmatory test results upon each proposed mix design. Use only mix designs accepted in writing by Landscape Architect.

c. All of the concrete on this project except concrete foundations that are below finished grade is intended to be limestone in color. The mix design and products for the mix design are described in section 32 1314 and shall be the mix for all exposed concrete described in this section.

2. Product Data: Submit to Landscape Architect:

a. Certified mill reports on cements.

b. Certified sieve analysis on aggregates.

c. Cement manufacturer's name and brand name.

d. Manufacturer's name and brand names of materials listed as products of more than one approved manufacturer.

e. Vapor Barrier

f. Waterproofing admixture

3. Truck Delivery Tickets: Include on each ticket:

a. Certification required by ASTM C94.

b. Type and brand name of cement.

c. Amount of cement, in pounds.

d. Total amount of water, in gallons.

e. Maximum size aggregate.

C. Samples: Approved samples shall be the standards for finishes in concrete work.

1. Concrete walls, and seat walls: Furnish 4’ long complete sections with specified finish, expansion joints, architectural jointing, and skateboard deterrents.

2. Concrete Stairs and steps: Submit sample for any anti-slip devises.

D. Shop Drawings:

1. Submit copies of drawings showing concrete construction of walls, caps and rails, including profiles and thickness, details of all lifting devices, joinery details, anchorage, sealing methods, water stops, finishes, location of all joints for all exposed concrete.

2. Shop Drawings: Submit copies of sub-slab shop drawings indicating expansion joint layout. Layout shall be submitted in conjunction with granite shop drawings. Expansion joints shall align accordingly.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Store new and reusable form lumber and form plywood under heavy waterproof coverings or where well protected from inclement weather.

B. Stack oiled form plywood on sticking to permit proper ventilation between uses.

C. Handle and store metal forms in such manner as to prevent damage by denting, warping, twisting and rusting.

D. Deliver reinforcing to site in easily handled bundles with identification tags securely wired into place. Store reinforcing to prevent damage and protect from corrosion and deformation.

1.6 GENERAL REQUIREMENTS:

A. All concrete work shall be true to line and grade as indicated on the drawings. The Contractor shall be responsible for proper drainage, without birdbaths, on all concrete paving surfaces. Any discrepancies or omissions on drawings, or conditions on the site, which prevent this Contractor from providing proper drainage shall be brought to the attention of the Owner in writing for correction or relief before work proceeds.

B. Do not embed piping, other than electrical conduit, in structural concrete. Locate conduit to maintain strength of structures at maximum. Verify size, length and location of electrical conduit.

C. Anchor plates, inserts and other items embedded in concrete shall be accurately secured so that they will not be displaced during placing of concrete.

D. Surface Tolerance: Finished paving surfaces shall not vary more than one-quarter (1/4") inch measured with a ten (10') foot metal straight edge, except at grade changes. No birdbaths or other surface irregularities will be permitted. Correct irregularities as directed.

1.7 ENVIRONMENTAL CONDITIONS:

A. Observe provisions of ACI-305 when ambient temperature is 90 degrees F. and greater.

B. Observe provisions of ACI-306 when ambient temperature is 40 degrees F. and less.

1.8 RECORDS: Maintain record of concrete placement, shoring and form removal. Record test cylinder strength used to determine early form removal. Keep record available for Landscape Architect's examination.

1.9 WARRANTY: Furnish written warranty issued by form release agent manufacturer that form release agent shall be non-staining and shall not interfere with applied finishes such as paint, mastic or mortar applied materials.

PART 2 - PRODUCTS

2.1 MIX DESIGN FOR ALL EXPOSED CONCRETE: (Refer to section 32 13 14)

A. The mix design specified in section 32 1313 shall be used for all exposed concrete and shall be provided by the same supplier. All exposed vertical concrete shall be 4000 psi.
B. Mix design for water feature components (Walls, Basins, etc.) shall include Xypex waterproofing admixture at a rate of 16 pounds per cubic yard.

2.2 MIX DESIGNS FOR FOUNDATIONS & SRUCTURAL CONCRETE: Reference Structural Specifications

2.3 REINFORCING:

A. Reinforcing Bars: ASTM A615, deformed billet-steel, clean and free from rust, scale, or coating that will reduce bond.

B. Welded Wire Fabric: Is not acceptable

C. Cold Drawn Steel Wire: ASTM A82.

D. Bar Chairs: 16 gauge galvanized steel wire, with three (3") inch X three (3") inch base, or solid plastic of proper sizes and design to properly support and position reinforcing steel.

2.4 METAL DOWELS: ASTM A36.

2.5 EXPANSION JOINT MATERIALS:

A. Premolded Joint Filler: To be "Sonoflex-F", a closed cell plastic joint filler, as manufactured by Sonneborn-Contech, Building Products Division, Contech, Incorporated, or approved equal.

B. Joint Sealant: To be "Sonolastic Sealant Two-Part" as manufactured by Sonneborn-Contech, Building Products Division, Contech, Incorporated, or approved equal. Color shall match adjacent concrete work.

C. All Expansion joints shall ½” thick Redwood or wolmanized pine: Preformed with dowels as provided by Contractors Paving Supply in Stafford, Texas or approved equal.

2.6 CURING MEMBRANE:

A. The Contractor shall submit a manufacturer of a spray on curing membrane to be used on all exposed concrete surfaces for approval. Conform to ASTM 309.

B. The Contractor shall select a fugitive color for above.

C. In lieu of above, the Contractor can submit a plan for slow curing all concrete for approval by the Landscape Architect.

2.7 VAPOR BARRIERS:

A. Vapor Barrier (Under all slabs) shall comply with ASTM E1745 Class A, maximum WVTR 0.008, minimum 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inchsieve and 0 to 5 percent passing a No. 8sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 WOOD FORMS:

A. Form Lumber: Number 1 Southern pine or Number 1 Douglas Fir-Larch, surfaced four sides; true and straight members free from cupping, warping, loose knots, excessive checking and other structural defects. Exposed concrete shall have an architecturally smooth finish equal to using masonite on the inside of the formwork.

B. Moldings and Chamfer Strips: "C-Select" or "Finish" Southern pine, straight, sound, and free of knots and other defects. Moldings and chamfer strips shall be sanded smooth and painted to avoid water absorption during concrete curing time resulting in the same finish as the adjacent form finished concrete.

C. Used form materials may be reused provided that they are thoroughly cleaned and acceptable finishes can be produced.

2.9 METAL FORMS:

A. Heavy gauge steel of sufficient strength to prevent undue deflection, properly braced. Use only materials with smooth and regular contact surfaces, free from dents and irregularities that affect regularity and finish surface of concrete.

2.10 FORM-FACING MATERIALS:

A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork and other form- facing material requirements.

B. Board-Form-Facing Panels for As-Cast Finishes: 1 by 6 inch nominal smooth sawn fir planks, offset lengths staggered, nonabsorptive that will provide continuous and true architectural concrete surfaces which exhibit a fine level of wood grain. Match approved mock-up. Leave

C. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch thick.

D. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS, that adheres to form joint substrates.

E. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.

F. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.

G. Form Ties: Factory-fabricated, glass-fiber-reinforced plastic ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish glass-fiber-reinforced plastic ties, 1/2 inch in diameter, of color selected by Architect from manufacturer's full range.
2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

H. Waterproofing for Fountain Basins and Walls: Bituthene BIT-017 system for Pools, Fountains, Steps as supplied by Grace.

1. Use Bituthene Liquid Membrane to smooth rough vertical areas.
2. Use Bituthene Deck Prep Surface Treatment to smooth rough deck areas

H. Waterstops: Superstop Bentonite Waterstop Material as supplied by Tremco.

PART 3 - EXECUTION

3.1 DESIGN OF MIXES AND PROPORTIONING:

A. Proportioning and mixing of cement, aggregate, admixture and water to attain required plasticity and strength shall be in accordance with ACI-304.

B. Concrete Mixture: Concrete mixtures shall be designed by an approved commercial testing laboratory at no expense to the Owner, using approved materials furnished by the Contractor to obtain a minimum compressive strength of 4,000 pounds per square

inch at 28 days of age and an air content by volume of six (6%) percent plus or minus 1.0 percent. The slump of the concrete shall be not more than four (4") inches.

3.2 SETTING FORMWORK:

A. Forms shall be constructed accurately to dimensions, plumb and true to line and grade. Forms shall be substantial, mortar tight and braced, and tied so as to maintain position and shape during placing of reinforcing and concrete. Wavy surfaces and bulged walls or slab surfaces resulting from settlement or springing of formwork will not be acceptable.

B. Do not re-use forms for exposed concrete surfaces. Coat all wood forms with form oil or release agent before pouring. Release agent shall be required on form surfaces where concrete is exposed to view in finished work.

C. The Contractor shall carefully examine Drawings and provide all recesses and all openings of proper sizes or shapes required or as may be directed by Landscape Architect for installation of all work requiring openings.

D. Forms shall be constructed and assembled in such a manner that construction joints shall occur at locations, where indicated on the drawings. Forms shall be thoroughly cleaned out before concrete is placed and forms may be removed without damage to concrete.

D. Forms for exposed concrete that is not specified as “board form finished” shall result in a smooth architectural finish equal to using masonite on the inside of the forms. All joints/seams in formwork shall be filled and sanded to result in a seamless finish.

E. Board-Form-Facing Panels for As-Cast Finishes: 1 by 6 inch nominal smooth sawn fir planks, offset lengths staggered, nonabsorptive that will provide continuous and true architectural concrete surfaces which exhibit a fine level of wood grain. Match approved mock-up.

F. Where joints are not indicated on the drawings, the seams in concrete form work shall be filled and sanded to avoid an interruption in the architecturally smooth concrete finish.

G. Care shall be taken in all details of forming, setting, reinforcing, mixing and placing all concrete exposed in finish work to obtain smooth, even surfaces of dense concrete, and clean sharp inside and outside corners, except where tooled corners are indicated. Use of form oil will be required to prevent concrete from bonding to form. Vibrator shall be used when requested.

H. Earthforms may be used for footings only where soil is firm and stable and concrete will not be exposed. Excavations shall be cut neat and accurate to size, and all exposed concrete shall be formed with the form extending at least six (6") inches below finish grade. Do not allow earth to dry, keep soil moist if exposed more than twelve (12) hours before pouring concrete.

I. Forms shall be carefully observed and checked for alignment and level as the work proceeds. All needed adjustment or additional bracing shall be done promptly. Form

ties shall be installed in an approved pattern since form tie recesses are a part of the design. Landscape Architect's approval is required.

J. After forms have been placed and approved, the Contractor shall see that all other trades have been properly notified and are given sufficient time to complete installation of their work. Placing of reinforcing steel shall proceed progressively with work of other trades and each shall arrange their working schedules so as to avoid disturbing or moving of work already installed by one trade to admit the work of another. Each trade shall be entirely responsible for proper installation and securing of the work and each shall keep his work under observation during placing of concrete.

K. Before pouring footings or foundations, see that bottoms of excavations are undisturbed earth free from water or frost, properly cleaned and leveled off and compacted as requirements of the ACI building code. Do not place on frozen earth, non-compacted fill or dried and cracked excavations.

L. Forms shall remain in place long enough to allow concrete to set properly and the Contractor shall assume all responsibility for removing same. In no case shall supporting forms or shoring be removed until concrete has sufficient strength to carry its own weight and the load upon it with safety. (See Curing.)

3.3 VAPOR BARRIER

A. Plastic Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturers recommended tape.

B. Granular Course: Cover vapor barrier with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

3.3 PLACING REINFORCEMENT:

A. Fabricate reinforcing steel in accordance with ACI-318 with tolerances conforming to ACI-301.

B. Place all reinforcement as shown on drawings. Place accurately and securely fasten and support reinforcement to prevent displacement before or during pouring. Hang footing bars from forms or use suitable reinforcing chairs. Support wire mesh with suitable reinforcing chairs.

C. Do not heat bars for bending or straightening. Do not tack weld bars.

D. Clean, bend and place reinforcement in accordance with current requirements of the ACI Manual of Concrete Practice.

E. Reinforcement Splices:

Welded wire fabric - one mesh minimum.

Reinforcing bars - 24 bar diameter minimum, except as otherwise noted.

3.4 PLACING CONCRETE:

A. Concrete shall be deposited so as to require as little rehandling as practicable. All placing equipment shall be clean and free from hardened concrete.

B. Placing shall be continuous between transverse joints or in individual sections of the work. Spade concrete thoroughly along forms and expansion joints, and work carefully into corners and around reinforcement. Tamp and screed to a dense mass. Vibrators may be used provided they are operated under experienced supervision and forms are constructed to withstand their action.

C. Convey concrete from mixer to place of final deposit in one continuous operation and until entire unit being placed is complete. Maintain plasticity of concrete to flow readily into formwork and embed reinforcement without segregation of aggregates.

D. Use chutes of uniform shape and slope controlling concrete fall to not more than three (3') feet.

E. Place no partially hardened, contaminated or retampered concrete.

F. Drag vibrators in horizontal position when consolidating thin concrete slabs. Do not use vibrators for concrete distribution.

3.5 FINISHES: Refer to 32 13 14

3.6 JOINTS: Reference Drawings for Locations of each type joint.

A. Score Joints: Score joints shall be formed in the fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained. All joints shall be struck before and after brooming/troweling. Contractor to fabricate special score joint tools as shown on plans.

B. Expansion Joints and Edging: Expansion joints shall be formed provided at the location and intervals as shown on the plans, and at all locations where concrete paving abuts buildings, curbs, or other structures. Approved joint material shall be placed with top edge one-half (1/2") inch below the paved surface and shall be securely held in place to prevent movement. Joint and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression. All edges shall be struck before and after brooming. After the curing period, expansion joints shall be carefully cleaned and filled with approved joint compound to one-quarter (1/4") inch below paved surface in such a manner as to avoid spilling on paved surfaces or overflow from joint.

3.7 WATERPROOFING: Install in accordance with manufacturers printed instructions.

3.8 CURING AND PROTECTION AND PATCHING

A. Protect concrete against frost, rapid drying and damage by rain and keep moist for at least seven (7) days after placing. Protect during this period by wet burlap, canvas covering (ASTM 171) or liquid curing compound. Curing by the use of saturated burlap. Sprinkler or membrane where approved shall commence immediately upon completion of finishing. Secure Owner's approval of proposed method. During this period, maintain concrete above 70 degrees F. for at least three (3) days or above 50 degrees F. for at least five (5) days. Concrete from which forms are removed within seven (7) days after pouring shall be sprayed during the curing period as frequently as drying conditions may require. Concrete covering shall be a type that will not stain or discolor finished concrete surfaces. Cure concrete in accordance with requirements of the current ACI Manual of Concrete Practice. Apply a spray on curing compound in accordance with manufacturer's recommendation and as specified herein where allowed.

B. Protect all concrete work against injury and defacement to walls and steps during subsequent construction operations, and until acceptance by the Owner.

C. PATCHING:

1. The use of "pavecrete" or other surfacing material will not be permitted.

2. Minor chips (2" X 2") or less which occasionally occur as a result of related construction activities may be patched using approved material.

3. The color and finish of all patches must exactly duplicate the surrounding pavement.

4. Remove any stains or spills on finished concrete work immediately.

5. Upon completion of the work clean all areas.

END OF SECTION 03 30 10

SECTION 03 35 00 - CONCRETE FINISHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Concrete curing and sealing compound. A ready-to-use, acrylic curing and sealing compound for use on new and existing, interior and exterior, horizontal and vertical concrete surfaces
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, application instructions, and recommendations. Include data substantiating product complies with requirements of the contract documents.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for the IBC for interior finishes.
   2. Accessibility Requirements: Comply with applicable requirements.
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS) 2012.

B. Manufacturer Qualifications: Provide products produced by a company specializing in production of concrete sealers for minimum of 5 years.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Do not proceed with installation until areas to receive Work are enclosed and temperature and relative humidity are stabilized and maintained for optimum quality control.

B. Environmental Limitations: Comply with coating manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and conditions affecting floor treatment application. Do not apply coating until wet Work in spaces is complete and dry; and overhead Work, including installing mechanical systems, lighting, and athletic equipment, is complete.
   1. Apply floor coatings when substrate temperature and surrounding air temperatures are between 50 degrees F and 95 degrees F (10 degrees F and 35 degrees C).
   2. Do not apply floor coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 MATERIAL

A. Concrete Sealer: Deep penetrating sealer, water based, clear, nonyellowing, nontoxic, VOC compliant concrete sealer, integral with concrete through chemical reaction forming nonsoluble seal within pores and capillaries of concrete and sealing it against ingress of moisture while allowing concrete to breathe.
   1. Basis of Specifications: Super Diamond Clear as manufactured by Euclid Chemical Company, (713) 392-7728. Subject to compliance with requirements, provide basis of design produce or comparable by one of the following:

a. Evercrete Company, Curecrete Chemical Company; (305) 538-8321.
b. PROSOCO, Inc.
c. WR Meadows.

2. Properties:
   a. Conform to ASTM C 309, Type 1, Class A & B and ASTM C 1315, Type 1, Class A.
   b. Dry Touch: < 1 hour.
   c. Recoat: 2 hours minimum.
   d. Foot Traffic: 2 to 4 hours.
   e. Wheel Traffic: 6 to 10 hours.
   f. VOC Content: 648 g/L.
   g. Solids Content (By Weight): > 25%.
   h. Moisture Loss per ASTM C156: < 0.40 kg/sq. m.
   i. Coverage:
      1) First Coat: Curing & Sealing Fresh Concrete: 300 to 400 sq.ft./gal.
      2) First Coat: Sealing or Resealing Existing/Cured Concrete: 400 to 450 sq. ft./gal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions affecting performance and conditions of floor treatment.
   1. Verify compatibility with and suitability of substrates, including existing finishes or primers.
   2. Verify plasticizers in existing concrete substrate will not impair bond.
   3. Proceed with installation after correcting unsatisfactory conditions

3.2 PREPARATION

A. Clean substrate, removing projections and substances detrimental to the Work; comply with recommendations of manufacturer of products to be installed for proper preparation procedures. Mask off or protect adjacent surfaces not scheduled to receive sealer.

3.3 APPLICATION

A. Spray apply sealer to comply with manufacturer's instructions except where project conditions require extra precautions or provisions to ensure satisfactory performance of the Work.
   1. Apply sealer to produce surface without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING

A. After completing application, clean spattered surfaces. Remove spattered sealer by washing or other appropriate methods for coating. Do not scratch or damage adjacent finished surfaces.

B. Clean Up: Remove rubbish, empty cans, rags, and discarded materials from site daily. Rinse and recycle or legally dispose of sealer and coating containers.

3.5 PROTECTION

A. Institute protective procedures and install protective materials as required to ensure that Work of this section will be without damage or deterioration at substantial completion.

END OF SECTION 03 35 00

SECTION 03 35 10.1 – TOPCAST EXPOSED AGGREGATE CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: **TOPCAST CONCRETE FINISH** produced through the use of a chemical surface retarder to expose the sand and fine aggregates of a concrete mix
B. Related Sections: Refer to the following sections for related work

Section 02200: "Earthwork"

Section 03300: "Cast-In-Place Concrete"

Section 05500: "Metal Fabrications"

Section: 07900: "Joint Sealants"

1.2 REFERENCES

A. American Concrete Institute (ACI)
B. American Society for Testing and Materials (ASTM)

C 31 Practices for Making and Curing Concrete Test Specimens in the Field

C 33 Specification for Concrete Aggregates

C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens

C 42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C 94 Specification for Ready-Mixed Concrete

C 143 Test Method for Slump of Hydraulic Cement Concrete

C 150 Specification for Portland Cement

C 172 Practice for Sampling Freshly Mixed Concrete

C 231 Test Method for Sampling Air Content of Freshly Mixed Concrete by Pressure Method

C 260 Specification for Air-Entraining Admixtures for Concrete

C 494 Specification for Chemical Admixtures for Concrete

D 994 Specification for Preformed Expansion Joint Filler for Concrete

1.3 SUBMITTALS

A. General: Submit the following items in accordance with the Conditions of Contract and Section 01330, "Submittal Procedures".

B. Product Data: Submit product data for the following materials and items.
C. Reinforcement
D. Forming Accessories
E. Admixtures
F. Chemical Surface Retarders
G. Patching Compounds
H. Sealants
I. Shop Drawings" Submit detailed drawings for fabrication, bending and placement of concrete reinforcement.
J. Show bar schedules, stirrup spacing, diagrams of bent bars and arrangement of reinforcement including bar overlap.
K. Include special reinforcement required for openings through concrete slabs or structures.
L. Laboratory Test Reports: Submit concrete test materials test reports and mix design reports certifying that each material or item complies with or exceeds the specified requirements.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:
   1. ACI 301 " Specifications for Structural Concrete for Buildings "
   2. ACI 304 " Guide for Measuring, Mixing, Transporting and Placing Concrete "
   3. ACI 305 " Hot Weather Concreting "
   4. ACI 306 " Cold Weather Concreting "
   5. ACI 308 " Standard Practice for Curing Concrete "
   6. ACI 309 " Standard Practice for Consolidation of Concrete "
   7. ACI 318 " Building Code Requirements for Reinforced Concrete "
   8. ACI 347 " Recommended Practice for Concrete Formwork "
   9. CRSI " Manual of Stamdard Practice "
   10. SP-66 " ACI Detailing Manual "

B. Mock-up Panels: Prepare one mock-up panel at the project site to demonstrate proficiency of the contractor as well as determine the best procedures and degree of sand or aggregate exposure. Mock-up panels shall be a minimum of 6' x 10'. Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the contractor. The approved mock-up panel shall serve as a standard of appearance for the final work to be produced.

C. Quality Control Testing During Construction: Contractor will engage independent concrete testing service for quality control during concrete construction operations.

   1. Notify owner's representative at least two (2) working days in advance of field operations requiring concrete testing, or of resumption of operations after stoppages.
   2. Coordinate concreting operations with testing service to facilitate quality control testing.
   3. Sample and test concrete during placement as follows:
      a. Sampling Fresh Concrete: ASTM C172: except modified for slump to conform with ASTM C94
      b. Slump: ASTM C143; test one for each concrete load at point of discharge and one for each set of compressive strength test specimens.
      c. Air Content ASTM C231: pressure method: one for each set of compressive specimens.
      d. Compressive Strength Tests: ASTM C39; one (1) set for each 150 cubic yards (115 cubic meters) or fractions thereof, of concrete class placed in any one day or for each 5,000 sq. ft. (465 sq. meters) of surface area placed; two (2) specimens

tested seven (7) days, three (3) specimens tested twenty eight (28) days and one (1) specimen retained in reserve for later testing if required.

PART 2 – PRODUCTS

2.1 FORM MATERIALS

A. Unless otherwise indicated, construct formwork with plywood metal, metal-framed plywood or other acceptable materials to provide continuous, straight, smooth exposed surfaces.
   1. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bowing or deflection.
   2. Provide forms that comply with US Product Standard PS 1 when applicable
      a. B-B High Density Overlaid Concrete Form, Class I
      b. B-B (Concrete Form) Plywood Class I, Exterior Grade or better, edge sealed, with each piece bearing legible inspection trademark.

   3. Form Coatings: Provide commercially formulated form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
      a. Acceptable Materials: "Form Seal 245" by Grace Construction Products. Customer Service Center 877-813-1710. www.graceconstructionproducts.com, or approved equal
      b. Dayton Superior Clean Strip
      c. Nox-Crete Form Coating
   4. Form Ties: where applicable Provide factory-fabricated, adjustable length, removable or snap off metal form ties, designed to prevent deflection and to prevent spalling concrete surfaces upon removal.

2.2 REINFORCING MATERIALS

A. Cold-drawn steel wire. ASTM A82

B. Welded wire fabric: ASTM A185, welded steel wire fabric, furnish in flat sheets, not rolls unless approved by the owners representative.

C. Reinforcing Bars: ASTM A615, deformed.

   1. Provide Grade 40 bars as required in details.
   2. Provide Grade 60 Bars No.3-18, except as otherwise noted.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.
   1. Use wire type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, stone, broken block or pieces of concrete.
   2. For concrete-on-grade, use supports with sand plates or horizontal runners if base material will not adequately support chair legs.
   3. For exposed – to – view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs, which are protected with plastic, stainless steel protected, or special stainless complying with CRSI Classes, C, D, or E, respectively.

E. Shop fabricate the reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors do not re-bend or straighten reinforcement in manner that will injure or weaken material.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C150 Types I-II and III, "Low-Alkali" cement unless otherwise specified. Use one brand of cement throughout the project unless otherwise approved by the owner's representative.
B. Aggregates: Shall be gap- graded conforming to C 33, size to be approved by the owner's representative dependant upon the type, color and etch of exposure desired.
C. Water: Potable, clean, fresh, free from oils, acids, organic matter or other deleterious substances.
D. Admixtures: All admixtures shall be specified in the mix design.
   1. Air-Entraining Admixtures: ASTM C 260
   2. Water-Reducing Admixture: ASTM C 494, Type A.
   3. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
   4. Chloride-containing Admixtures are not permitted.

2.4 RELATED MATERIALS

A. Expansion Joint Materials
   1. Typical Building: ASTM D 994, preformed strips of a bituminous mastic compositions
   2. Slabs – in Ground and Sidewalks: ASTM D 1751, preformed expansion joint filler having relatively little extrusion and substantial recovery after release from compression.

B. Liquid Membrane – Forming Curing Compound: ASTM C 309, Type I or I-D, Class A.

2.5 CONCRETE MIX DESIGN

A. General Top-Cast, " Ready Mixed " concrete unless otherwise approved or specified; in accordance with ASTM C 94. Exposed Aggregate Concrete should meet or exceed the following criteria.
   1. Compressive Strength: Minimum 3,000 psi strength at 28 days
   2. Concrete shall be gap-graded with weathered rounded coarse aggregate consisting of not more than 45% - 50% maximum content.
   3. Water/Cement Ratio: Not greater than .55 by weight.
   4. Slump: Not greater than 4 inches.
   5. Air Content: Between 4 ½% - 7 ½%

B. Admixtures
   1. Use water-reducing admixtures in all concrete.
   2. Use air-entraining admixture in all exterior exposed concrete.

2.6 PLANT, EQUIPMENT, MACHINES AND TOOLS

A. General: Plant, equipment, machines and tools used in the workplace shall be subject to approval and shall be maintained in a satisfactory working condition at all times.
   1. Provide equipment with capability of producing the required product, meeting or exceeding grade controls, thickness control and smoothness requirements as specified.

2. Use of equipment shall be discontinued if it produces unsatisfactory results.
3. Owner's representatives shall have access to the plant and all equipment to ensure proper operation and compliance with the specifications at all times during construction.

PART – 3 EXECUTION

3.1 FORM SETTING

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.
B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
C. Design formwork to be readily removable without impact, shock or damage to cast - place –concrete surface and adjacent materials.
D. Provisions for other trades: Provide openings in concrete formwork and slabs to accommodate other trades.
E. Tolerances: set forms with the upper edge true to line and grade with an allowable tolerance of ¼" (6mm) in any 10 foot (3 m) long section.

3.2 PLACING REINFORCEMENT

A. Comply with CRSI's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports.
B. Clean reinforcement of all loose rust and mill scale, earth, ice, oil, concrete splatter from previous pours and other materials, which reduce or destroy bond with concrete.
C. Accurately position, support and secure reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
D. Install welded wire fabric of same gage in as long of lengths as is practical. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps of adjacent widths to prevent continuous laps in either direction.

3.3 PREPARATIONS FOR PLACING CONCRETE

A. Remove water from excavations. Before placement, remove wood chips, shavings, and hardened concrete etc. from forms.
   1. Clean all equipment.
   2. Wet forms, except in freezing weather, or oil properly with approved release.
B. Earth shall be uniformly moist when concrete is placed. Sprinkling method shall not be such as to form mud or pools of water. Watering sub-grade immediately prior to concrete placement is not sufficient to make the soil uniformly moist.
C. Notify other trades to permit installation of their work. Coordinate installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

3.4 PLACING CONCRETE

A. Notify owner's representative 24 hours in advance prior to placement.
B. Filed Inspection: Do not place concrete until forms and reinforcing steel have been inspected and approved.
   1. Place Ready-Mix concrete within specified time after batching.
      a. Below 40 degrees F (4 degrees C) See Cold Weather Placing

b. 40 – 85 degrees F (4-29 degrees C) 90 minutes
c. 86 – 90 degrees F (30-32 degrees C) 75 minutes
d. Above 90 degrees F (32 degrees C) 60 minutes

* Concrete exceeding delivery times may be rejected by the owner's representative

2. Adding Water: Do not add water after initial introduction of mixing water for batch except when slump of concrete is less than specified upon jobsite arrival and the maximum water/cement ratio has not been exceeded.
   a. Notify owner's representative prior to adding any additional water.
   b. Add only water enough to bring concrete slump within the specified limits. Turn drum at least 30 additional revolutions at maximum mixing speed. Do not add water to batch at any later time.
   c. Ensure that concrete strength meets or exceeds specified requirements, and water does not exceed maximum amount specified in the approved CONCRETE MIX DESIGN.

C. General: Comply with ACI 304, as specified herein.
   1. Place concrete continuously or in layers of such thickness that the concrete will not be placed on a preceding layer which has hardened sufficiently to cause formation of seams or planes of weakness.
   2. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable to its final location to avoid segregation.

D. Placing Concrete in Forms:
   1. Consolidate placed concrete by high frequency mechanical vibrating equipment, supplemented as necessary by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

      a. Do not use vibrators to transport concrete inside forms.

      b. Insert and withdraw vibrators vertically at uniformly spaced locations not further visible effectiveness of the machines being used. Generally 16-20" apart.

      c. At each insertion, limit duration of vibration time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in continuous operation, within the limits of construction joints, until placement of panel or section is completed. Maintain reinforcing in proper position during concrete placement operations

F. Placing Concrete Sidewalks: Place concrete in forms in one (1) layer of such thickness that when consolidated and finished, sidewalks will be of thickness indicated.

G. Cold Weather Placing: Protect concrete work from physical damage or reduced strength caused by frost, freezing actions, or low temperatures, comply with ACI 306.

H. Hot Weather Placing:When hot weather conditions exist that would seriously impair the quality and strength of concrete place concrete in accordance with ACI 305 and as herein specified.

3.5 CONCRETE FINISHING

A. General: The use of a rolling tamper, jitterbug or rolling jitterbug shall be considered when producing micro etched concrete surfaces. This will enable the finisher to create a denser surface paste with no obstruction due to the appearance of coarse aggregate, allowing for a uniform sand texture.
1. Protect all curbs, borders and adjacent concrete and masonry surfaces, pavers, stones etc. that are not to receive retarder finish prior to concrete placement and retarder application using **Grace "Face Off"**
2. Place concrete in the manner prescribed previously. Screed or strike off the surface in two (2) directions using a wooden or metal straight edge to achieve the proper elevation in a sawing motion back and forth.
3. Allow the bleed water to evaporate the surface. It can than be floated using a wooden hand float or a bull-float preferably wooden to close the surface and surround the coarse aggregate with cement paste. Float to a uniform appearance. Follow float operations with hand trowels or Fresno steel trowels to create tight dense smooth surface. (This may require two or three passes depending upon mix design and or desired finish to be achieved)
NOTE: *Do not burnish the surface or allow the micro etched surface to prematurely dry prior to the application of Top Cast*.

B. Concrete Surface Retarders

Spray Applied, film forming top surface retarder, calibrated for specific sized aggregates and finish requirements without plastic covering. Color coded to allow for ease of application and verification of grade being used as well as even and complete coverage.

Acceptable Materials:

1. **" TOP CAST "** by Grace Construction Products. Customer Service Center, 877-813-1710, www.graceconstructionproducts.com

2. Bomanite Surface Deactivator (303) 369-1115 www.bomanite.com

3. Top-Cast Decorative Surface Retarder by Dayton (888) 977-9600 www.daytonsuperior.com

Spray Applied, film forming protective coating for adjacent masonry and concrete surfaces.

Acceptable Materials: **" FACE OFF "** by Grace Construction Products. Customer Service Center, 877-813-1710, www.graceconstructionproducts.com

1. Soon after the final seat finish has been completed spray **Grace "Top Cast"** surface retarder using a low-pressure sprayer with a 0.5gpm tip at a rate of 200—350 sq./ft. per gallon in a full hiding coat.

a. Once dry **Grace " Top Cast "** will yield a coating that provides intermittent rain protection. Once completely dry it can be covered to protect the surface if heavy extended rains are predicted.

Retarder Selection Guide

Number / Aggregate Size to Expose / Color

03 / Acid Etch Finish / Lt. Blue Violet
05 / Sand Texture Finish / Lt. Blue
15 / up to ¼"agg. / Yellow
25 / 1/8" to ¼" agg / Beige
50 / 1/8" to 3/8" agg. / Canary Green
75 / ¼"-3/8" agg. / Blue
100 / 3/8" to ½" agg. / Gray
125 / 3/8" to 5/8" agg. / Pink
150 / 3/8" to 5/8" agg. / Green
200 / 5/8" to 1" agg. / Salmon
250 / 1" to 1 ½" agg. / Lt. Orange

4. Wash surface with water rinse using stiff brooms and water hose or by high pressure washing with power equipment as early as 4- 6 hours in very hot weather or the following day up to 24 hours. Retarder removal intervals are dependent upon strength of the concrete mix, aggregate size and desired washing techniques. Earlier washing on the light etches may be necessary. Verify in accordance with the mock-up approval detailed herein.
5. Rinse water and cement matrix removal shall be in accordance with local codes and should not be allowed to be washed or flow down to arroyos, storm sewers, ponds, streams or sanitary sewers by precipitation or other surface flows.
6. Prior to completion of the project, remove wash water residue from the site to location approved by the local district.

3.7 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Immediately cut out honeycomb, rock pockets and voids over ¼ inch (6mm) in any dimension as well as holes left by tie rods, bolts etc. down to solid concrete but, in no case to a depth less than 1 inch (25mm).
   1. Cut edges perpendicular to concrete surface.
   2. Thoroughly clean, dampen with water, and brush coat area to be patched with neat cement grout or proprietary bonding agent before placing cement mortar or proprietary patching compound.

B. Remove and replace concrete with defective surfaces if defects cannot be repaired to the satisfaction of the owner's representative.
   1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface as well as stains and other discolorations that cannot be removed by cleaning.
      a. Dampen concrete surfaces in contact with patching concrete and brush with neat cement grout or apply concrete bonding agent.
      b. Mix Patching concrete of same materials to provide concrete of same type of class as original concrete.

c. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

END OF SECTION 03 35 10.1

SECTION 03 35 19 - INTEGRALLY COLORED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Integrally colored finishes for site-cast concrete.
   2. If this Section conflicts with Related Sections:
      a. This Section takes precedence for matters that affect concrete appearance.
      b. Related Sections take precedence for matters that do not affect concrete appearance.
      c. In case of conflicts, notify Landscape Architect for clarification.

1.2 REFERENCE STANDARDS

A. ACI 301 – Structural Concrete.

B. ACI 303.1 – Cast-in-Place Architectural Concrete.

C. ACI 305.1 – Hot Weather Concreting.

D. ACI 306.1 – Cold Weather Concreting.

E. ACI 308R – Curing Concrete.

F. ACI 318 – Building Code Requirements for Structural Concrete.

G. ASTM C309 – Liquid Membrane-Forming Compounds for Curing Concrete.

H. ASTM C979 – Pigments for Integrally Colored Concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference:
   1. Conduct conference at Project site.
   2. Comply with Division 01 Section "Project Management and Coordination"
   3. Review procedures required to produce specified results.

1.4 SUBMITTALS

A. Product Data:
   1. Color additives.
   2. Curing products.
   3. Form release agents.
   4. Proprietary cleaning agents.
   5. Surface retarders.

B. Shop Drawings: Indicate extent of each color of integrally colored concrete.

C. Samples for Initial Selection: Submit color additive manufacturer's sample chip set.

D. Samples for Verification: Submit sample chip of specified concrete colors indicating color name.

E. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with: ACI 301, ACI 305.1, ACI 306.1, ACI 318.

B. Obtain each material from same source and maintain high degree of consistency in workmanship throughout Project.

C. Installer Qualifications: Concrete work shall be by firm with five years experience with work of similar scope and quality.

D. Field Samples: Submit three samples 60 by 60 inches indicating concrete color range and texture.

E. Integrally Colored Concrete Mock-Up:
   1. Provide full-scale mock-up under Division 01 Section "Quality Requirements" Construct at least one month before start of other concrete work to allow concrete to cure before observation.
   2. At location acceptable to Architect, demonstrate methods used for construction, including forming and finishing conditions required for Project using materials, workmanship, joint treatments, form ties, patching techniques, and curing methods to be used throughout Project.
   3. Accepted mock-up provides visual standard for work of Section.
   4. Remove mock-up when no longer required for comparison with finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Color Additive: Deliver, store, and handle in accordance with manufacturer's instructions.

B. Concrete: Schedule delivery to provide consistent mix times from time color additive is placed in mixture until placement of integrally colored concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cements:
   1. Types: As specified in Related Sections.
   2. Colors: As required to match Reference Sample.

B. Supplementary Cementitious Materials:
   1. Types: As specified in Related Sections.
   2. Colors: As required to match Reference Sample.

C. Fine Aggregate:
   1. Types: As specified in Related Sections.
   2. Color: As required to match Reference Sample.

D. Coarse Aggregate:
   1. Types: As specified in Related Sections.
   2. Color: As required to match approved concrete sample.

E. Water: Clean and potable.

F. Admixtures: Do not use calcium chloride admixtures.

2.2 COLOR ADDITIVES

A. Manufacturer:
   1. Butterfield Color
      Contact Information:
      a. Phone: 800-282-3388
      b. E-mail: decorativeconcrete.orders@us.sika.com
      c. Web Site: www.butterfieldcolor.com.
   2. L.M. Scofield Company, Chromix
      a. Phone: 770-920-600
   3. SIKA USA
      a. Phone: (800) 800-9900 or the appropriate local contact

B. Type:
   1. Concentrated pigments specially processed for mixing into concrete and complying with ASTM C979.

C. Color Additive Delivery:
   1. Automated Dispensing: Meter and dispense colors using computer-controlled automated color weighing and dispensing system. Use Butterfield Color Uni-Mix Liquid Dispensing System.

2.3 FORMED CONCRETE

A. Forms and Form Facing Materials:
   1. Type: High density and non-vapor transmitting form face, free of rust or other defects deleterious to required finish, and with watertight joints.

B. Form Ties: Corrosion-resistant ties, removable cones, and plugs.

C. Form Release: Use type that is non-staining and minimizes formation of bug-holes.

D. Curing Compound for Formed Surfaces: Complying with ASTM C309 and approved by color additive manufacturer for use on integrally colored concrete. Do not use white-pigmented curing compounds.

2.4 ACCESSORIES

A. Reinforcing Bar Supports: Use corrosion-resistant types at locations contacting exposed surfaces.

B. Joint Sealants:
   1. Provide type specified in Division 07 Section "Joint Sealants"
   2. Color: Color selected by [Architect from manufacturer's full range to match integrally colored concrete.

C. Cleaning Agents: Use products recommended by manufacturer’s specification.

2.5 MIXES

A. Slump: If greater slump is required, use water-reducing or super-plasticizing admixture; do not add water.

B. Color Additives: Mix in accordance with manufacturer's instructions. Mix until color additives are uniformly dispersed throughout mixture and disintegrating bags, if used, have disintegrated.

C. Do not retemper mix or add water in field.

2.6 CONCRETE COLORS

A. Concrete Colors: Provide color additives that, along with specified concrete materials, result in concrete to match.

B. Concrete Colors:
   1. Provide colors to be selected by Landscape Architect from manufacturer’s full range of colors. Reference drawings for selected colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not place integrally colored concrete where standing water is present.

3.2 INSTALLATON

A. Comply with color admixture manufacturer’s recommendations unless otherwise specified in this Section.

3.3 FORMED SURFACES

A. Concrete Paving:
   1. Meet requirements outlined in 32 13 13 – 4 of the Project Manual.

   2. Reference Plans for Colored Concrete Location and Condition/Surface Finish.

   3. Match sample finish. Contractor must reproduce a mockup of the sample finish on an area at least 25 square feet.

B. Curing and Stripping:
   1. Curing: Cure for 28 days. Maintain concrete between [65° and 85°F] during curing.
   2. Leave forms in place for as long as practical, and do not strip until concrete has reached a consistent age.
   3. Stripping: If forms are removed before required curing duration, apply curing compound for formed surfaces. To extent practical, integrally colored concrete throughout project should be cured using the same methods and for the same durations.
   4. Do not cover concrete with plastic sheeting.

C. Repair:
   1. Fill holes and defects in concrete surface within 48 hours of form removal.
   2. Use patching materials and techniques approved in mock-up.
   3. Make patches with stiff mortar made with materials from same sources as concrete. Adjust mortar mix proportions so dry patch matches dry adjacent concrete. Add white cement to mortar mix if necessary to lighten it. With exposed aggregate finishes, add

aggregate to mortar mix so patches will have same texture and appearance as adjacent concrete.

3.4 APPEARANCE TOLERANCES

A. Appearance: Minor variations in appearance of integrally colored concrete that are similar to natural variations in color and appearance of uncolored concrete are acceptable.

3.5 CLEANING

A. Efflorescence: Remove efflorescence as soon as practical after it appears.

B. Use least aggressive cleaning techniques possible.

C. If proprietary cleaning agents are used, pre-wet surface, test cleaning agent on small, inconspicuous area, and check effects prior to proceeding. At walls, begin cleaning at top and work down. Thoroughly rinse surface afterwards with clean water. Follow cleaner manufacturer's instructions.

D. Do not use muriatic or hydrochloric acid on integrally colored concrete.

END OF SECTION 03 35 19

SECTION 03 52 16 - LIGHTWEIGHT INSULATING CONCRETE DECK SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. It is the intent of this Section,
   1. to include the metal decking, lightweight insulating concrete, and EPS roof insulation, and
   2. that all Work be performed by the lightweight insulating concrete Sub-contractor.

1.3 RELATED WORK

A. All Sections of Work pertinent to the roofing system, including mechanical, plumbing and electrical items penetrating metal deck, lightweight insulating concrete, roof insulation, and subsequent roofing.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.

B. Mix Design: Indicate materials and proportions of proposed mix.

C. Applicator’s Qualifications: Refer Paragraph 1.5, A.

D. Certifications:
   1. Manufacturer’s affidavit that materials used in Project contain no asbestos.
   2. On completion of installation, furnish Architect with Certificate signed by a representative of the manufacturer and by the applicator stating that insulating concrete was prepared and applied in accordance with manufacturer's recommendations.
   3. Manufacturer’s certification that system meets UL-90 wind up-lift and UL Class A fire rating.

1.5 REFERENCES

A. Comply with all applicable recommendations of the referenced standards. In any conflict between referenced standards, the more stringent requirements shall govern.
   1. American National Standards Institute/Underwriters’ Laboratories, Inc. (ANSI/UL)
   2. ASTM International (ASTM)
      a. A525, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
      b. C150, Standard Specification for Portland Cement
      c. C495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete
      d. C796, Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam

e. E119, Standard Test Methods for Fire Tests of Building Construction and Materials

3. Underwriters' Laboratories, Inc. (UL)
   a. Wind Uplift Class 90
   b. Fire Ratings - Class A

1.6 QUALITY ASSURANCE

A. Applicator:
   1. Approved in writing by manufacturer to install the lightweight insulating concrete deck system and which has been in business for at least five (5) years.
   2. Responsible for ensuring positive drainage.
   3. No ponding water will be acceptable.
   4. Perform water test prior to application of roof system. Architect will be present, so notify 24 hours in advance.

B. Agency Approvals: Provide products, execution, and material thickness to conform to the applicable code requirements for the required fire resistance ratings, wind uplift classifications, insulation values, and diaphragm values.

C. Diaphragm Construction: Incorporate metal decking thickness, welding pattern, and minimum compressive strength of the lightweight insulating concrete to achieve diaphragm design values for edge and field conditions as specified to meet applicable code requirements.

D. Fire Resistance Classifications: Provide a lightweight insulating concrete system meeting the following fire resistance standards:
   1. Tested by UL in accordance with the procedures of ASTM E119 and listed in the UL "Fire Resistance Directory".
   2. Approval Rating: Class A

E. Wind Uplift Classifications: Provide a lightweight insulating concrete system meeting the following wind uplift standards:
   1. Tested by UL in accordance and listed in the UL "Roofing Materials Directory" for wind uplift resistance.
   2. Approval Rating: UL-90

F. Inspection and Testing Laboratory Services:
   1. Test results shall meet or exceed established Standards. Refer to Section 01 45 23, Testing and Inspecting Services.
   2. The Owner will select the Inspection and Testing Laboratory and pay for the cost of tests to determine the dry density and compressive strength.
   3. Compressive strength shall be determined in accordance with ASTM C495.
   4. Test cellular concrete in accordance with ASTM C796.

G. Building/Construction Components: Meet or exceed established standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened packaging fully identified as to manufacturer, brand or other identifying data as approved in submittal documents.

B. Store materials under cover, and in a dry location until ready for installation. Roofing insulation must always be covered or stored in a dry area when not being used.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload the structure.

D. Familiarize every member of the installation crew with the manufacturer's material safety data sheets and with fire and safety regulations recommended by OSHA, NRCA, and as required by governing codes of authorities having jurisdiction.

1.8 PROJECT / SITE CONDITIONS

A. When air temperatures of 40 degrees F or above are predicted to occur within the first 24 hours after placement, normal installation procedures may be used.

B. Do not install lightweight insulating concrete system when air temperatures are below 40 degrees F, including wind chill.

1.9 SEQUENCING AND SCHEDULING

A. Sequence, schedule and coordinate placement of lightweight insulating concrete roof insulation with work in other sections so as not to interfere with efficient roof insulation application.

1.10 WARRANTY

A. Manufacturer's Warranty: Warrant the decking and associated Work in conjunction with the roofing manufacturer from the project date of Substantial Completion as follows:
   1. The warranty shall be a NDL "No Dollar Limit" / no penal sum type, with total replacement cost. Refer to roof system specification section for length of warranty period.
   2. The warranty shall provide manufacturer's maximum extended wind rated coverage (up to Hurricane force winds) as defined by the Beaufort Scale.
   3. The warranty shall guarantee the entire roof system and associated work against defective materials and workmanship of installation, with NO exclusion for ponding water.
   4. The full system warranty including lightweight insulating concrete deck, roofing insulation, flashing, metal work, labor, and material shall be guaranteed against failure of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.

B. Contractor Warranty: Jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the lightweight insulating concrete deck will be and remain in good condition for a five (5) year warranty period, after the Architect accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the Contractor, and subcontractors, to make good the requirements of the warranty.

C. Make arrangements with the roofing manufacturer to provide the required warranty. Final warranty shall be submitted to Owner at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products and manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5)

years experience manufacturing products meeting or exceeding the specifications, and comply with Division 1 requirements regarding substitutions to be considered.

1. Elastizell Corp. of America
2. Celcore, Inc.
3. Mearlcrete

2.2 MATERIALS

A. Metal Deck: Refer to Section 05 31 00. Corrugated steel decking incorporating a pre-applied galvanized coating conforming to ASTM A653, minimum Class G-90 and having slots in flutes equal to a minimum of 0.75 percent of the deck area. Refer to Structural Drawings for size, type and section modulus of metal deck and for welding pattern of deck.

B. Insulation Board:
1. Thickness: 6 inches thick typically, unless shown otherwise. Type I EPS
2. Approved Products/Manufacturers:
   a. "Holey Board" manufactured by Alleguard

C. Any one (1) of the following products from a single manufacturer is approved for use on this Project:
1. Cellular: Mix shall be 1:3 with minimum compressive strength of **300 psi**, cast density of 34-42 pcf, manufactured by Elastizell Corporation of America, Ann Arbor, MI (734) 761-6900

D. Cement: Portland type, conforming to ASTM C150, Type I or III.

E. Admixtures: Air entraining types and superplacticizer (water reducer) types as recommended by insulating concrete material manufacturer. Admixtures may be injected into material at the plant. The use of calcium chloride is not permitted.

F. Water: Potable water that is clean and free of deleterious amounts of acid, alkali, and organic materials – (Drinkable).

G. Expansion Joint Material: One (1) inch thick of type recommended by insulating concrete material supplier for expansion joints in structural system.

H. Reinforcing: 3/4 inch long, polypropylene fiber, Fibermix as manufactured by Fibermesh Co. for cellular concrete only.

I. Nailers: (Refer to Section 06 10 00, Rough Carpentry) As shown on drawings. Install required thickness of wood to align with specified thickness of lightweight insulating concrete.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Prior to erection of forms, inspect structural supports to ensure that they are secure and in place.

B. Prior to placing insulating concrete, inspect corrugated metal forms to ensure that they are secured to the structure and free of debris or foreign materials.

C. Notify other trades of dates of pouring in ample time for each to install his work.

3.2 INSTALLATION

A. Metal Deck: Place sheets with corrugation edges upon the perpendicular to supports with end laps centered over supports. Attach to supports with plug welds through welding washers. Refer to Structural Drawings for additional requirements.

B. Expansion Joint Material: Install at the following locations.
1. Perimeter of deck.
2. Changes in direction of roof deck.
3. Structural roof penetrations and expansion joints

C. Provide equipment and installation procedures conforming to the materials manufacturer's installation instructions.

D. Mix Portland cement and foam in a mix ratio design with water in accordance with manufacturer's instructions to achieve the specified wet density, minimum dry density, and minimum compressive strength.

E. Install slurry coat of lightweight insulating concrete over metal deck to minimum thickness of 1/4 inch over top of flutes of metal decking.

F. Place insulation boards into slurry within 30 minutes of applying lightweight insulating concrete in accordance with manufacturer's instructions.

G. Walk board into slurry to ensure proper embedding of insulation boards into lightweight insulating concrete and keying with insulation holes. Hold boards back two (2) inches from all penetrations and perimeter. Place boards with staggered joints in running bond pattern.

H. Fill holes in the insulation boards and place a two (2) inch minimum thickness of lightweight insulating concrete over top of the insulation boards within four (4) hours after installation of insulation boards. Build all crickets and saddles shown with lightweight insulating concrete sloped to drain as indicated on drawings.

I. Deposit insulating concrete fill and screed (without troweling, rodding, tamping, or vibrating) immediately after mixing. Place on surfaces clean and free of loose matter. Place no concrete when temperature is 40 degrees F or falling.

J. All wood blocking for deck penetrations support and low roof deck to rise wall blocking shall be installed one (1) inch higher than designed lightweight fill thickness. Install fill in a two (2) foot tapered edge condition.

K. Allow insulating concrete fill to dry as thoroughly as possible before application of roofing, and not less than the minimum time recommended by the manufacturer. Begin roofing when the insulating concrete fill can withstand construction traffic (usually two (2) to three (3) days after placement), verify/confirm with manufacturer's recommendations. Do not leave insulating concrete fill deck surface exposed for longer than ten (10) days. Install no more insulating concrete fill than can be roofed within the ten (10) day time limit.

L. Where material is to be pumped, equipment shall be in good condition and well maintained to avoid equipment failure and delays.

M. Install and cure lightweight insulating concrete in accordance with manufacturer's instructions.

N. Avoid roof-top traffic over the lightweight insulating concrete deck system until 24 hours have elapsed after last placement of lightweight insulating concrete.

O. Allow lightweight insulating concrete to dry as thoroughly as possible before application of roofing. Testing Laboratory may perform tests to determine moisture content of lightweight insulating concrete.

P. Add two (2) pounds of fiber reinforcing per cubic yard of lightweight insulating concrete if cellular concrete is used.

3.3 FIELD QUALITY ASSURANCE

A. The Owner will select the independent inspection and testing laboratory and pay for the cost of tests in accordance with Division 1.

B. The independent inspection and testing laboratory will randomly sample and verify the following:
1. Mix design compressive strength in accordance with ASTM C495.
2. Mix design wet and dry density range in accordance with ASTM C495.
3. Polystyrene insulation density in accordance with ASTM C578.
4. Base ply fastener pull tests shall be performed three (3) days or more following the installation of the lightweight insulating concrete to ensure a minimum withdrawal resistance of 40 pounds per fastener. Submit test results to Architect.
5. Thermal insulation value in accordance with ASTM C177

C. Retests for work which fail initial tests or inspections shall be paid by contractor.

D. Results of all tests will be made available to all concerned parties.

E. Water Test: Run water on the finished deck for the Architect's observation. The lightweight insulating concrete shall slope to drain and no ponding of water will be accepted. Also, no slopes less than 1/4 inch per foot will be allowed.

F. Certification: On completion of installation, furnish Architect with certificate signed by a representative of the manufacturer and by the applicator stating that insulating concrete was prepared and applied in accordance with manufacturer's recommendations.

3.4 CLEANING

A. Remove equipment, excess materials, debris, and trash at the completion of installation of the lightweight insulating concrete deck system.

B. Remove visible lightweight insulating concrete from underside of metal deck where it is exposed to normal view.

C. Wash floors below the lightweight insulating concrete deck system after each days installation or as necessary and remove wash water.

3.5 PATCHING AND REPAIRING

A. Perform all patching and repairing of lightweight insulating concrete using the same materials specified in this Section or materials approved by the system manufacturer.

B. The party responsible for damage will be charged for repairs.

3.6 PROTECTION

A. Lightweight insulating concrete installer shall be responsible for protecting newly applied decks from all adverse conditions until Roofing Contractor begins installation of specified roof system.

B. General Contractor shall be responsible for protection of roof deck from other trades until it has been approved for traffic by installer.

END OF SECTION

SECTION 03 54 00 - CAST UNDERLAYMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

B. Related Sections:
   1. Section 01 73 00 - Execution: Alteration project procedures; selective demolition for remodeling.

1.3 REFERENCE STANDARDS

A. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Manufacturer's Instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).

1.6 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Specifications are based on products named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 MATERIALS

A. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

B. Primer: Manufacturer's recommended type.

C. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

B. Vacuum clean surfaces.

C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

D. Close floor openings.

3.3 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.
   1. Pump, move, and screed while the material is still highly flowable.
   2. Be careful not to create cold joints.
   3. Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).

D. For final thickness over 1-1/2 inches (38 mm), place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.

E. Place before partition installation.

F. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.4 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION 03 54 00

SECTION 04 05 00 - COMMON WORK RESULTS FOR MASONRY

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:
   1. Mortar and grout for masonry assemblies.
   2. Ties and anchors.
   3. Embedded flashing.
   4. Penetrating water repellents.
   5. Miscellaneous masonry accessories.
   6. Cleaning exposed unit masonry surfaces.

B. Related Sections:
   1. Section 04 01 20 - Maintenance of Unit Masonry: Cleaning of Masonry.
   2. Section 04 22 00.13 - Concrete Unit Veneer Masonry: CMU for veneer.
   3. Section 05 50 00 - Metal Fabrications: Steel embeds and lintels.
   4. Section 07 92 00 - Joint Sealants: Sealants for control and expansion joints.

1.3 REFERENCE STANDARDS:

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016, with Editorial Revision (2018).

E. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2024.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

G. ASTM B32 - Standard Specification for Solder Metal; 2020.

H. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

I. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2024.

J. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.

K. ASTM C114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement; Current Edition.

L. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

M. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

N. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

O. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

P. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

Q. ASTM C476 - Standard Specification for Grout for Masonry; 2020.

R. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

S. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.

T. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2020.

U. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

V. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber; 2020.

W. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2018.

X. ASTM D2287 - Standard Classification System and Basis for Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds; Current Edition.

Y. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.4 DEFINITIONS

A. Very Low Pressure Spray: Under 100 psi (690 kPa).

B. Low Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Mix design for mortar and grout shall be submitted for review.

C. Supplier’s certificates indicating materials comply with the specifications below. They shall include, but are not necessarily limited to:
   1. Aggregates.
   2. Cement.
   3. Admixtures.

D. Shop Drawings:
   1. For the following:
      a. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

E. Samples for Initial Selection:
   1. Colored mortar.
   2. Weep holes/vents.

F. Samples for Verifications:
   1. For each type and color of the following:
      a. Pigmented and colored-aggregate mortar. Make samples using same sand and mortar ingredients to be used on Project.
      b. Weep holes and vents.
      c. Accessories embedded in masonry.

G. Material Certificates:
   1. For each type and size of the following:
      a. Cementitious materials. Include brand, type, and name of manufacturer.
      b. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
      c. Grout mixes. Include description of type and proportions of ingredients.
      d. Anchors, ties, and metal accessories.

H. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 - Project Management and Coordination.

C. Tests and Inspections:
   1. All tests and inspections herein are to be performed by an independent testing laboratory approved by the building official.
   2. Mortar and grout tests:
      a. At the beginning of masonry work, at least one (1) test sample each of mortar and grout shall be taken on three (3) successive working days, then once per week with at least one sample taken for each 5,000 square feet of wall area, or fraction thereof:
         1) Test specimens shall be made in accordance with ASTM C1019 for grout and ASTM C780 for mortar.
         2) Test specimens shall be continuously stored in moist air until tested.
         3) Mortar shall show a compressive strength of not less than 1,800 psi at 28 days. Grout shall show a compressive strength of not less than 2,000 psi at 28 days.

D. Paint Remover Manufacturer Qualifications: Firm having minimum five (5) years' documented experience who regularly engages in producing masonry cleaners, and with factory authorized service representatives who are available for consultation and site inspection, preconstruction product testing, and onsite assistance.

E. Chemical Cleaner Manufacturer Qualifications: Firm having minimum five (5) years' documented experience who is regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory authorized service representatives who are available for consultation and site inspection, preconstruction product testing, and onsite assistance.

F. Cleaning Program:
   1. Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used; protection of surrounding materials; and control of runoff during operations. Include provisions for supervising worker performance and preventing damage:
      a. If materials and methods other than those indicated are proposed for any phase of cleaning work, add a written description of such materials and methods, including evidence of successful use on comparable projects and demonstrations to show their effectiveness.

G. Pre-Installation Conference:
   1. Conduct conference at Project site:
      a. Verify masonry cleaning equipment and facilities needed to make progress and avoid delays.
      b. Materials, material application, and sequencing.
      c. Cleaning program.
      d. Coordination with building occupants.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2 PRODUCTS

2.1 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type N or S as indicated in masonry section.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime,complying with specified requirements and containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Quicklime: ASTM C5.

F. Lime Putty:
   1. Made from hydrated lime or quicklime:
      a. If made from quicklime, other than processed pulverized quicklime, slake lime and then screen through a No. 16 mesh sieve. Before using, store and protect slaked and screened lime putty for not less than 10 days.
      b. Processed pulverized quicklime shall be slaked for not less than 48 hours, and shall be cool when used.
      c. Lime putty prepared from hydrated lime may be used immediately after mixing.
      d. Lime putty prepared from quicklime or pulverized quicklime shall have a plasticity figure, after slaking and screening, of not less than 200, and shall weigh not less than 83 pounds per cubic foot. Lime putty prepared from hydrated lime shall conform to ASTM C207, Type S.

G. Aggregate:
   1. For mortar: ASTM C144.
   2. For grout: ASTM C404.

H. Admixtures:
   1. Cold Weather Admixture:
      a. Non-chloride, non-corrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated:
         1) Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
            (a) BASF Corporation.
            (b) Euclid Chemical.
            (c) GCP Applied Technologies.
         2) Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

I. Water: Potable.

2.2 MORTAR MIXES

A. General:

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated:
    a. Do not use calcium chloride in mortar.
    b. Use masonry cement or mortar cement mortar unless otherwise indicated.
    c. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-Blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
1. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
2. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide Type S or Type N as indicated in related Section.
1. Type S mortar shall have a 28 day compressive strength of not less than 1,800 psi.

D. Mortar shall be made with admixtures that are proportioned, added and mixed in strict accordance with manufacturer's directions.

E. Mortar mix shall be proportioned by volume; one-part portland cement, not less than 1/4-part nor more than 1/2-part lime putty, and sand totaling not less than 2-1/4 nor more than three (3) times sum of volumes of cement and lime used:
1. Total clay content shall not exceed 2 percent of sand content or six percent 6 percent of cement content.

2.3 GROUT MIXES

A. Grout for Unit Masonry: Comply with ASTM C476.
1. Grout shall have a 28-day compressive strength of not less than 2,000 psi (14 MPa). Proportion by volume and with sufficient water to produce consistency for pouring without segregation so that grout will flow into masonry joints.
2. Proportion by volume and with sufficient water to produce consistency for pouring without segregation so that grout will flow into masonry joints.

B. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that complies with TMS 402/602 for dimensions of grout spaces and pour height.
1. Fine Grout:
    a. One-part portland cement, to which may be added not more than 1/10 part lime putty, and three-parts sand.
    b. Fine grout shall be used for all grout spaces less than 3 inches wide.
2. Coarse Grout:
    a. One-part portland cement, to which may be added not more than 1/10 part lime putty, three-parts sand, and not less than one-part nor more than two-parts pea gravel (3/8 inch maximum aggregate size).
    b. Coarse grout shall be used in grout spaces 3 inches wide or more.

C. Grout Additive:

2.4 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A951/A951M.
1. Masonry joint reinforcement used in exterior walls shall be hot-dipped galvanized, conforming to ASTM A153/A153M, Class B, minimum coating of 1.5 ounce for square foot.

B. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch diameter, hot-dip galvanized, carbon-steel continuous wire.

C. Reinforcing Bars:
   1. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

D. Reinforcing Bar Positioners:
   1. Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Form units from 0.148 inch (3.77 mm) steel wire, hot dip galvanized after fabrication. Provide units designed for number of bars indicated:
   2. Manufacturers:
      a. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
         1) Heckmann Building Products, Inc.
         2) Hohmann & Barnard, Inc.
         3) Wire-Bond.

2.5 TIES AND ANCHORS

A. General:
   1. Sheet Metal Anchors and Ties - ASTM A1008/A1008M:
      a. Sheet metal anchors and ties used in exterior walls shall be hot-dipped galvanized, conforming to ASTM A153/A153M, Class B.

2.6 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034 inch galvanized steel sheet.

2.7 EMBEDDED FLASHING MATERIALS

A. Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and/or Section 07 62 00 - Roof Related Sheet Metal and as follows:
   1. Stainless Steel: ASTM A240/A240M, Type 304, 0.016 inch thick.
   2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16 ounces per square foot weight or 0.0216 inch thick or ASTM B370, Temper H01, high-yield copper sheet, 12 ounces per square foot weight or 0.0162 inch thick.
   3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
   4. Fabricate through-wall metal flashing embedded in masonry from copper, with ribs at 3 inch intervals along length of flashing to provide an integral mortar bond:
      a. Products are subject to compliance with requirements; available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Cheney Flashing Company: Cheney Flashing (Dovetail).
         2) Keystone Flashing Company, Inc: Keystone 3-Way Thruwall Flashing.
      b. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
   5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
   6. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
   7. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.

8. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
9. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
10. Metal sealant stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
11. Metal expansion-joint strips: Fabricate from stainless steel to shapes indicated.

B. Flexible Flashing:
1. Use one of the following unless otherwise indicated:
a. Copper-Laminated Flashing: 5 ounces per square foot copper sheet bonded between two (2) layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry:
1) Products are subject to compliance with requirements; available products that may be incorporated into the Work include, but are not limited to, the following:
(a) Hohmann & Barnard, Inc.
(b) Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
b. Asphalt-Coated Copper Flashing: 7 ounces per square foot copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry:
1) Products are subject to compliance with requirements; available products that may be incorporated into the Work include, but are not limited to, the following:
(a) Advanced Building Products Inc.
(b) Hohmann & Barnard, Inc.
(c) Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
2) Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Application:
1. Unless otherwise indicated, use the following:
a. Where flashing is indicated to receive counterflashing, use metal flashing.
b. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
c. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge with a sealant stop or flexible flashing with a metal sealant stop.
d. Where flashing is fully concealed, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:
1. Solder for stainless steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for copper: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.8 LIQUID SURFACE TREATMENTS

A. Penetrating Water Repellent:
1. Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components, odorless, that penetrates, hardens, and densifies concrete surfaces:
2. Manufacturers:
a. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years'

experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

b. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures .

3. Basis of Design: Moxie Shield 1400 Surface Sealer or Moxie Shield Shield 1300 Brick Sealer as manufactured by Moxie International Inc.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane.

B. Preformed Control Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.10 CLEANING MATERIALS (VERIFY WITH LOCAL ORDINANCE)

A. Water: Potable.

B. Hot Water: Water heated to a temperature of 140 degrees F to 160 degrees F (60 degrees C to 71 degrees C).

C. Detergent Solution - Job Mixed: Solution prepared by mixing two cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every five gallons (20 L) of solution required.

D. Mold, Mildew, and Algae Remover - Job Mixed: Solution prepared by mixing two cups (0.5 L) of tetrasodium pyrophosphate (TSPP), five quarts (5 L) of five percent (5%) sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every five gallons (20 L) of solution required.

E. Non-Acidic Gel Cleaner:

1. Gel formulation, with pH between six (6) and nine (9) that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces:
2. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered:
   a. AHI Supply Co.
   b. PROSOCO, Inc.
3. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

F. Non-Acidic Liquid Cleaner:

1. Mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood:
2. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered:
3. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

G. Mild acid cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches:

1. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications

are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered:

2. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

H. Acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors:
   1. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered:
   2. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

I. Two-part chemical cleaner system consisting of potassium - or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid:
   1. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered:
      a. AHI Supply Co.
      b. Diedrich Technologies, Inc.
      c. PROSOCO, Inc.
   2. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.11 CHEMICAL CLEANING SOLUTIONS

A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical cleaner manufacturer.

B. Acidic Cleaner Solution for Non-Glazed Masonry and Unpolished Stone:
   1. Dilute acidic cleaner with water to produce hydrofluoric acid content of three percent (3%) or less, but not greater than that recommended in writing by chemical-cleaner manufacturer:
      a. Stones: Use only on unpolished granite, unpolished dolomite marble, and siliceous sandstone.

C. Acidic Cleaner for Galzed Masonry Glazed Masonry and Polished Stone:
   1. Dilute acidic cleaner with water to concentration demonstrated by testing that does not etch, or otherwise damage glazed or polished surface, but not greater than that recommended in writing by chemical-cleaner manufacturer:
      a. Stones: Use only on polished granite and polished dolomite marble.

2.12 MASKING MATERIALS

A. Liquid Strippable Masking Agent:
   1. Liquid, film forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners:
   2. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered:
   3. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Protection of Masonry:
   1. During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress:
      a. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
      b. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Stain Prevention:
   1. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry:
      a. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
      b. Protect sills, ledges, and projections from mortar droppings.
      c. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
      d. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements:
   1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602:
      a. Cold-weather cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

3.2 COORDINATION

A. Build openings and chases for heating, plumbing, electrical ducts, pipes, and conduits into masonry walls as necessary. Install bolts, toggles, flashings, beams, anchors, hangers, nailing strips, wall plugs, and frames as necessary:
   1. Coordinate related work incorporating installation of work to prevent subsequent cutting and patching.
   2. Coordinate installation of steel reinforcement for reinforced masonry.
   3. Coordinate dampproofing, waterproofing, and air infiltration membrane activities with masonry construction.
   4. Coordinate placement of concrete in masonry beams, lintels, soffits, and pilasters.

3.3 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work:
   1. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the work.
   2. Verify foundations are within tolerances specified.
   3. Verify reinforcing dowels are properly placed.
   4. Verify substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation after correcting unsatisfactory conditions.

3.4 MORTAR AND GROUT

A. Mixing Mortar and Grout
   1. Accurately measure materials in suitably calibrated devices; shovel measurements are not acceptable. Each 94 pound sack of Portland cement will be considered as 1 cubic foot.
   2. Place sand, cement, and water in mixer, in that order, and mix for at least 2 minutes. Add lime putty and continue mixing as long as necessary to secure a uniform mass, but in no case less than 10 minutes.
   3. Use mixers of at least o1 sack capacity; batches requiring fractional sacks will not be permitted unless cement is weighed for each batch.

B. Grouting Procedures
   1. As specified in Related Section(s).

C. Retempering
   1. When necessary to retemper mortar, add water and remix; retempering by dashing water over mortar will not be permitted.
   2. Any mortar that is unused within 30 minutes after initial mixing and any mortar that has begun to set shall not be used.

D. Defective Mortar or Grout
   1. Should the strength of mortar or grout fall below that specified, remainder of Work shall be adjusted to reach required strength. Work in place representing inferior grout and mortar and indicating a strength less than the minimum specified shall be tested by taking and testing core samples. Number and location of cores shall be determined by Structural Engineer.
   2. Should compression tests of cores fail to meet required strength, masonry shall be deemed to be defective and shall be removed and replaced at no cost to Owner.
   3. Costs relative to taking and testing of core samples shall be paid by Owner and will be deducted from Contract amount. Cost of patching core holes shall be borne by Contractor.

3.5 INSTALLATION, GENERAL

A. Construct masonry veneer in compliance with TMS 402/602.

B. Thickness: Build single wythe walls to actual widths of masonry units, using units of widths indicated.

C. Build chases and recesses to accommodate items specified in this and other Sections.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

E. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures:
   1. Mix units from several pallets or cubes as they are placed.

G. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

H. All masonry shall be laid true, level, plumb, and as indicated on Drawings.

3.6 TOLERANCES, GENERAL

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch; do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
2. For exposed bed joints, do not vary from bed joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.7 LAYING MASONRY, GENERAL REQUIREMENTS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond. Do not use units with less than nominal 4 inch (100 mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

G. Fill all cores in hollow CMU with grout.

3.8 MORTAR BEDDING AND JOINTING

A. Lay masonry units as indicated in appropriate Section.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct applied finishes (other than paint) unless otherwise indicated.

D. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, or air barriers unless otherwise indicated.

3.9 MASONRY JOINT REINFORCEMENT

A. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c.
   2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond opening in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T shaped units.

D. Provide continuity at corners by using prefabricated L shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 ANCHORED VENEERS

A. Ties and Anchors: Extend ties and anchors a minimum 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16 mm) cover on outside face.

B. Provide not less than 1/2 inch of airspace between back of masonry veneer and face of masonry:
   1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.11 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than 2 inches wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.
   3. Anchor masonry with anchors embedded in masonry joints and attached to structure.

B. Anchor veneers to concrete masonry backup with masonry anchor ties and veneer ties as indicated on the Drawings. Comply with the following requirements:
   1. Embed anchor ties in masonry joints as indicated on Drawings.

2. Fasten veneer ties to masonry backup through loops of anchor ties projecting from masonry surface.
3. Space anchors ties as indicated, but not more than 12 inches o.c. vertically and 12 inches o.c. horizontally, with not less than one (1) anchor for each 1 square foot of wall area. Install additional anchors at openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.

3.12 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete backup with seismic masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached and seismic anchors through sheathing to wall framing and to concrete backup with metal fasteners of type indicated. Use two (2) fasteners unless anchor design only uses one (1) fastener.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one (1) anchor at each stud in each horizontal joint between sheathing boards.
   3. BIA Technical Notes 28B recommends 2 inches (50 mm) of air space. Wider air spaces require closer tie spacing.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   5. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one (1) anchor for each 2 square feet of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
   6. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than one (1) anchor for each 3-1/2 square feet of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.13 CONTROL AND EXPANSION JOINTS

A. Install expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 - Joint Sealants, but not less than 3/8 inch:
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.14 LINTELS

A. Provide steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 24 inches (610 mm) for block size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.15 FLASHING, WEEPS, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
   1. Install flashing as follows unless otherwise indicated:
      a. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
      b. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.

c. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
d. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant for application indicated.
e. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
f. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

2. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

B. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches o.c. unless otherwise indicated.
4. Retain last subparagraph above if weep holes other than plastic tubing or wicking are used. Retain first subparagraph below if plastic tubing or wicking is used.
5. Space weep holes formed from plastic tubing or wicking material 16 inches o.c.
6. Trim wicking material flush with outside face of wall after mortar has set.

D. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" article.

F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents:
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections:
1. Special inspections according to Level C in TMS 402/602:
a. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
b. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
c. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One (1) set of tests.

D. Testing Frequency: One (1) set of tests for each 5,000 square feet (464 sq. m) of wall area or portion thereof.

E. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

3.17 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: During construction, minimize any mortar or grout stains on the wall. Immediately remove any staining or soiling that occurs:
   1. For precision or textured units, except as noted below, clean masonry by dry brushing before tooling joints.
   2. For burnished, glazed, or pre-finished concrete masonry units, immediately remove any green mortar smears or soiling with a damp sponge.

D. Final Cleaning - After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. After mortar is thoroughly set and cured, clean exposed masonry:
      a. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
      b. Test cleaning methods on sample wall panel; leave 1/2 of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
      c. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
      d. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
      e. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
      f. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
      g. Do not use acids on concrete masonry units.
      h. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

E. At completion of masonry work, remove all scaffolding and equipment used during construction, and remove all debris, refuse, and surplus masonry material from the site:
   1. Comply with Construction Waste Management plan.

3.18 MASONRY WASTE DISPOSAL

A. Refer to Section 01 74 19 - Construction Waste Management and Disposal.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

3.19 WATER REPELLENT APPLICATION

A. Cleaning shall be complete and accepted by Architect, and wall surfaces shall be thoroughly dry prior to application.

B. Apply water repellent in strict accordance with water repellent manufacturer's instructions.

END OF SECTION 04 05 00

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SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Concrete masonry units (CMU)

B. Face brick, including solids.

C. Natural Stone.

1.3 DEFINITIONS

A. CMU: Concrete masonry unit.

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 RELATED WORK

A. Section 01 45 23 - Testing and Inspecting Services.

B. Section 05 50 00 – Metal Fabrications. Steel masonry lintels.

C. Section 07 11 00 – Bituminous Dampproofing.

D. Section 07 21 00 – Thermal Insulation.

E. Section 07 92 00 – Joint Sealants.

F. Section 09 90 00 – Paintings and Coatings.

G. All Sections of Work built-in, adjacent to, or applied to unit masonry Work.

1.5 REFERENCES

A. ASTM International (ASTM)
1. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron & Steel Hardware.
2. A307 - Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
3. A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
5. C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
6. C90 - Standard Specification for Loadbearing Concrete Masonry Units.
7. C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units.
8. C144 - Standard Specification for Aggregate for Masonry Mortar.
9. C150, Standard Specification for Portland Cement.
10. C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
11. C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

12. C270 - Standard Specification for Mortar for Unit Masonry.
13. C331 - Standard Specification for Lightweight Aggregates for Concrete Masonry Units.
14. C332 - Standard Specification for Lightweight Aggregates for Insulating Concrete.
15. C404 - Standard Specification for Aggregates for Masonry Grout.
16. C476 - Standard Specification for Grout for Masonry.
17. C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
18. C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
19. C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
20. C979 - Standard Specification for Pigments for Integrally Colored Concrete.
21. C714 -
22. D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
23. D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
24. E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. The Masonry Society (TMS).
   1. TMS 402 / 602: Building Code Requirements and Specification for Masonry Structures.

C. Underwriters' Laboratories, Inc. (UL).

1.6 QUALITY ASSURANCE

A. Where requirements of this Section are in conflict with requirements noted on the Structural Drawings, the Structural Drawings shall take precedence. Refer to Structural Drawings for information on load-bearing CMU walls.

B. Fire Performance Characteristics: Where indicated or required, provide materials and construction which are identical to assemblies whose fire endurance has been determined by testing in compliance with ASTM E119 by U.L. or other recognized testing and inspection organization or by other means, acceptable to authority having jurisdiction.

C. Masonry Cleaning: Workers shall have minimum 5 years of masonry cleaning experience, and shall be approved by cleaner manufacturer prior to application of cleaning material, and shall meet with cleaner manufacturer for demonstration and instruction s for use of product prior to application.

D. Perimeter Walk-Around: Daily perimeter walk-around the exterior side of the masonry by the GC and or masonry Subcontractor at the end of each Work day as a visual inspection looking for obvious issues or flaws concerning colors, finishes, workmanship, protection of Work.

E. CMU must exceed unit strength required to satisfy f'm 2000 psi (2500 psi) per TMS 402/602. Contractor my document compliance with actual prism tests provided tests are performed 28 days prior to beginning work on site.

F. Single Source Responsibility:
   1. For Masonry Units: Obtain masonry units of uniform texture and color, or a uniform blend within the accepted ranges for those characteristics, from one (1) manufacturer for each different product required for each continuous surface or visually related surfaces.
   2. For Mortar and Grout Materials: Brands of cementitious materials and admixtures, and the source of supply of sand and aggregates shall remain the same throughout the Work where exposed to view and where not scheduled to receive a subsequently applied finish, i.e. parging, painting, etc., unless directed otherwise in writing by the Architect.

3. Contractor's Responsibility: Contractor performing Work of this Section shall be responsible for coordinating with others performing Work which is built-in or adjacent to unit masonry Work.

1.7 SUBMITTALS

A. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Samples: Two (2) sets of color chips representing manufacturer's full range of available colors and textures of each face brick for Architect's selection and approval.

C. Sample Panel(s):
1. Do not start masonry until Architect has approved samples.
2. Sample panel shall be 6 feet long by 8 feet high showing selected color range and texture, bonding, joint shape, and quality of workmanship. Include a brick and expansion joint, and any specialty details, such as reveals, soldier courses, etc. Include mock-up of installation of thru-wall flashing at foundation sill and lintel above openings, window jambs and sills.
3. A separate panel for each type of masonry used is required.
Sample panel(s) shall remain at the jobsite until all masonry is completed.
Installed materials shall be visible and integrated into adjacent materials.
4. Brace and support as required to withstand structural wind loads.

D. Certification: Submit manufacturer's affidavit that materials used in Project contain no asbestos.

E. Mortar and Grout Mix Designs: Submit two (2) copies of proposed mortar and grout mix designs to Owner's testing laboratory.

1.8 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 – Project Management and Coordination.

1.9 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for [**each type of exposed unit masonry construction**] [**typical exterior wall**] [**typical interior wall**] [**typical exterior and interior walls**] in sizes approximately 72 inches (1800 mm) long by 72 inches (1800 mm) high by full thickness, including face and backup wythes and accessories.
   a. Include a sealant filled joint at least 16 inches (400 mm) long in each mockup.
   b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
   c. Include through wall flashing installed for a 24 inch (600 mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12 inch (300 mm) length of flashing left exposed to view (omit masonry above half of flashing).
   d. Include [**metal**] [**wood**] studs, sheathing, **water resistive barrier, sheathing joint and penetration treatment, air barrier**, veneer anchors, flashing**, cavity drainage material**, and weep holes in exterior masonry veneer wall mockup.
   e. Include each type of masonry on one face of interior unit masonry wall mockup.

3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean one/half of exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather resistant membrane.
6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 TESTS AND INSPECTIONS

A. Materials and installation of masonry shall be subject to testing and inspection by an independent testing laboratory. Such tests and inspections shall not relieve Contractor of responsibilities for providing materials and procedures which comply with Contract Documents. Promptly remove and replace materials which do not comply.

B. Owner will select Inspection and Testing Laboratory and will pay for all Work required by Inspection and Testing Laboratory.

1.11 DELIVERY, STORAGE AND PROTECTION

A. Deliver and store materials in dry protected areas off ground. Keep free of stain or other damage before, during and after installation. Replace any damaged material at no cost to Owner.

B. During freezing weather, protect masonry units with tarpaulins or other suitable material. Keep free of stain or other damage before, during and after installation. Replace damaged material at no cost to Owner.

C. Protect reinforcement and accessories from elements.

1.12 SITE CONDITIONS

A. Cold Weather Protection:
   1. No masonry shall be laid when the temperature of the outside air is below 40 degrees F, unless protection measures are employed and pre-approved by the Architect.
   2. Protection measures for cold weather erection include maintaining space and masonry unit temperatures of at least 40 degrees F for 48 hours prior to and after erection.

B. Hot Weather Protection:
   1. When the mean daily temperature exceeds 100 degrees F or exceeds 90 degrees F with a wind velocity greater than 8 mph, fog spray all newly constructed masonry until damp, at least three (3) times a day until the masonry is three (3) days old.

1.13 BRACING OF MASONRY DURING ERECTION

A. All masonry shall be adequately braced at all times during erection.

1.14 COORDINATION

A. Openings and chases for heating, plumbing, electrical ducts, pipes, and conduits shall be built into masonry walls as required. Provide for installation of bolts, toggles, flashings, beams, anchors, hangers, nailing strips, wall plugs, and frames as required. Consult other trades in advance and make provisions for installation of their Work to avoid cutting and patching. Coordinate installation of steel reinforcement for reinforced masonry. Coordinate placement of concrete in masonry beams, lintels, soffits, and pilasters.

B. Contractor performing Work of this Section shall be responsible for and coordinate with work of Section 07 11 00, Dampproofing Above Grade and all Sections of Work built-in, adjacent to, or applied to unit masonry Work.

1.15 WARRANTY

A. Warrant the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:
1. Noticeable deterioration of unit or mortar finish.
2. Chalking or dusting excessively.
3. Changing color in irregular fashion.
4. Cracking or spalling.
5. Releasing from substrate.
6. Staining or discoloring, including efflorescence.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Must have a minimum of five (5) years' experience manufacturing products equal to those specified and comply with requirements of Division 1 regarding substitutions to be considered.
1. Face Brick Manufacturers: Subject to compliance with requirements, provide products of one of the following:
a. Cloud Ceramics
b. Belden.
c. Endicott Clay
b. Interstate Brick
c. Kansas Brick and Tile

2. Concrete Masonry Units (CMU/Block) Manufacturers: Subject to compliance with requirements, provide products of one of the following:
a. Upchurch Kimbrough Co.
b. Texas Building Products, Inc.

3. Natural Stone
a. Upchurch Kimbrough Company
b. US Stone
c. Global Stone Services
d. Quality Stone Company

2.2 MATERIALS

A. Concrete Masonry Units (CMU/Block):
1. Type/Sizes:

a. Concealed cavity block and interior block, unless otherwise noted: Regular smooth face units with 8 inch by 16 inch face dimensions as shown on drawings or required, 4 inch, 6 inch, and 8 inch depths as indicated on drawings.
   1) Color: As selected by Architect.

b. Exterior exposed block: Regular Smooth face units with 8 inch by 16 inch face dimensions as shown on drawings or required, 4 inch, 6 inch, and 8 inch depths as indicated on drawings.
   1) Color: As selected by Architect.

c. Exterior exposed burnished block: Integrally colored face units with 8 inch by 16 inch face dimensions with half scored partition as shown on drawings or required, 4 inch, 6 inch, and 8 inch depths as indicated on drawings.
   1) Color: As selected by Architect.

d. Exterior exposed split faced block: Integrally colored face units with 8 inch by 16 inch face dimensions as shown on drawings or required, 4 inch, 6 inch, and 8 inch depths as indicated on drawings.
   1) Color: As selected by Architect.

e. Interior block, unless otherwise noted: Regular smooth face units with 8 inch x 16 inch face dimensions as shown on drawings or required, 4 inch, 6 inch, and 8 inch depths as indicated on drawings.

f. Interior exposed burnished block: Integrally colored face units with 8 inch by 16 inch face dimensions with half scored partition as shown on drawings or required, 4 inch, 6 inch, and 8 inch depths as indicated on drawings.
   2) Color: As selected by Architect.

g. Interior exposed solid burnished block with half scored partition and double chamfered corners:
   1) Color: As selected by Architect
   2) Size: As shown on drawings.

2. Integral Water Repellant (In exterior exposed CMU): “Dry-Block Block Admixture” integral water repellant admixture as manufacturer by Grace Construction Packaging (gcp), or equal.
3. Specification: Comply with ASTM C90 (Class D-2 (2 hour) and Class B-4 (4 hour)) block at rated walls).
   a. Aggregate: Lightweight in accordance with ASTM C331.
4. Curing: Rotary kiln process.
5. Provide bond beams, control joints, jambs, lintels, soaps, cap blocks, and fillers to match and complement block units as shown or required.

B. Face Brick: Western King Size Facing Brick 2-3/4 x 2-5/8 x 9-5/8 complying with ASTM C 216. including solids and special shapes as indicated or required (all colors).
   1. Grade: SW.
   2. Type: FBX.
   3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi (23.10 MPa).
   4. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67.
   5. Efflorescence: Provide brick tested according to ASTM C 67 and is rated *not effloresced*.
   6. Size (Actual Dimensions):

a. King Size Units: 2-3/4 inches wide by 2-5/8 inches high by 9-5/8 inches long

7. Application: Use where brick is exposed unless otherwise indicated.

8. BK 1:
   a. Basis of Design: Cloud Ceramics.
   b. Color: 70% Driftwood, 30% Brown Tweed.
   c. Texture: Velour.

C. Utility Brick: 3-5/8 x 3-5/8 x 11-5/8 complying with ASTM C 216. including solids and special shapes as indicated or required (all colors).
   1. BK 2:
      a. Basis of Design: Belden.
      b. Color: Vintage Gray.
      c. Finish: Glazed.

D. Natural Stone: Refer to Plans:
   1. SMV-1:
      a. Basis of Design: US Stone
      b. Stone: Linear Limestone.
      c. Color: Flint Hills Gray.
      d. Size: Varying lengths, not to exceed 2 feet and be at least 1 foot.
      e. Finish: Honed

   2. SMV-2:
      a. Basis of Design: US Stone.
      b. Stone: Linear Limestone.
      c. Color: Flint Hills Gray.
      d. Size: Varying lengths, not to exceed 2 feet and be at least 1 foot.
      e. Finish: Split.

   3. SMV-3:
      a. Basis of Design: Upchurch Kimbrough/ Alamo Stone.
      b. Stone: Limestone.
      c. Color: Stonehaven.
      d. Finish: Rough Chop.

E. Cement Backer Board: Cementitious, water durable, board; surfaced with fiberglass reinforcing mesh.
   on front and back, long edges wrapped; and complying with ANSI A118.9 and ASTM C 1325 (Perma Base BRAND Cement Board).
   1. Thickness: ½ in., 5/8 in.
   2. Width: 2 ft. 8 in., 3 ft., or 4 ft.
   3. Length: 4 ft., 5 ft., 6 ft., or 8 ft.
   4. Edges: Tapered.
   5. Compressive Strength: Not less than 2250 lbs. per sq. in. when tested in accordance with ASTM D 2394.
   6. Water Absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C 473.

F. Fasteners:
   1. Screws: Hi-Lo thread screws (No. 8) wafer head, corrosion-resistant, 1-5/8 in length , and complying with ASTM C 1002

2. Use above for wood and 22 ga. or lighter steel framing. Use below for 20 ga. or heavier steel framing.
3. Screws: Drill point screws (No. 8) wafer head, corrosion-resistant 1-5/8 in length and complying with ASTM C 1002.

PART 2 - JOINT TREATMENT:

1. Tape: Alkali-resistant fiberglass mesh tape intended for use with cement board.

PART 3 - ADHERED MASONRY VENEER INSTALLATION SYSTEM:

3.1 BASIS OF DESIGN: LATICRETE OR APPROVED MANUFACTURER APPROVED BY ARCHITECT.

PRODUCT DATA SHEET 1 - Laticrete MVIS Thin Brick Mortar (Skim Coat).
PRODUCT DATA SHEET 2 - Laticrete MVIS Air and Water Barrier Membrane.
PRODUCT DATA SHEET 3 - Laticrete MVIS Thin Brick Mortar (for Adhesion).
PRODUCT DATA SHEET 4 - Laticrete MVIS Masonry Pointing Mortar.

PART 4 - MORTAR:

1. Materials: (Unless stated otherwise on Structural Drawings)
   a. Portland Cement: ASTM C150, Type 1.
   b. Hydrated Lime: ASTM C207, TYPE “N”, typical. Use TYPE “S” for load-bearing masonry.
   c. Aggregate: Sand conforming to ASTM C144.
   d. Water: Clean and potable.
   e. Admixtures For Mortar:
      1) General: Do not use calcium chloride
      2) Concrete Masonry Units: Spectrum Mortar Color or Architect approved equal.
      3) Natural Stone Units: Spectrum Mortar Color or Architect approved equal.
      4) Face Brick: BK 1: Spectrum Mortar Color Almond / Vanilla
      5) Face Brick: BK 2: Spectrum Mortar Color Light Black
      6) Face Brick: BK 3: Spectrum Mortar Color Light Quarry
      7) Integral Water Repellant (In mortar of exterior exposed CMU): “Dry- Block Mortar Admixture” integral water repellant admixture as manufacturer by Grace Construction Packaging (gcp) or equal. Note: Water repellent block admixture and mortar admixture are not interchangeable.

2. Mix Design: (Proportions by volume) (Unless stated otherwise on Structural Drawings)
   a. Typical, Non-load bearing masonry
      1) Type: ASTM C270, Type “N.”
      2) Proportions: 1 part cement, 1 part hydrated lime and 6 parts sand to provide a compressive strength of 750 psi in 28 days. Do not use calcium chloride.

   b. Load bearing structural masonry
      1) Type: ASTM C270, Type “S.”
      2) Proportions: 1 part cement, 1/2 part hydrated lime and 4-1/2 parts sand to provide a compressive strength of 1800 psi in 28 days. Do not use calcium chloride.

PART 5 - GROUT:

1. Materials: (Unless stated otherwise on Structural Drawings)
   a. Hydrated Lime: ASTM C207, TYPE “S.”

b. Portland Cement: ASTM C150, Type 1.
c. Water: Clean and potable
d. Aggregates:
   1) Course aggregate shall conform to ASTM C404.
   2) Fine aggregate shall conform to ASTM C144.

2. Mix Design: (Unless stated otherwise on Structural Drawings)
   a. Comply with ASTM C476 to provide a compressive strength of 2,500 psi in 28 days, unless noted otherwise. Do not use calcium chloride.
      1) Fine Grout: Fine grout conforming to ASTM C476 and consisting of 1 part Portland cement, 0 to 1/10 part lime and 2-1/4 to 3 parts sand by volume.
      2) Course Grout Mix: Course grout conforming to ASTM C476 and consisting of 1 part Portland cement, 0 to 1/10 part lime and 2-1/4 to 3 parts sand, and 1 to 2 parts course aggregate.

PART 6 - REINFORCEMENT, ANCHORS AND TIE SYSTEMS:

1. General: Reinforcement used in all wythes shall be galvanized after fabrication in accordance with ASTM A153, Class B-2.
2. Approved Manufacturers include the following:
   a. Heckmann Building Products
   b. Hohmann & Barnard, Inc
   c. Wire-Bond

3. At solid multiple wythe masonry walls and single wythe masonry walls, (Interior partitions) use #9 gauge truss type reinforcing. Pre-fab corners and tees shall be used at all wall corners and intersections; width shall be two (2) inches less than nominal thickness of walls. Hohmann & Barnard "120 Truss-Mesh" at single wythe; "230 Ladder-Tri-Mesh" at multiple, or Architect approved equal.
4. At Double Wythe Cavity Walls with Insulation Board: Use Hot-dipped galvanized, #9 gauge truss type with 3/16 inch adjustable pintle wall ties. Width of truss reinforcement shall be 2 inches less than the nominal thickness of wall. 3/16 inch wall tie double eye sections welded at 16 inches o.c. extended as required for insulation thickness. Pre fab corners and tees shall be used at all wall corners and intersections. Hohmann & Barnard, Inc. "270 Ladder Eye-Wire", or Architect approved equal.
5. At Masonry Anchored to Steel Spandrel Beam and Columns: Hot-dipped galvanized DW-10HS and V-Tie manufactured by Hohmann & Barnard, Inc. or Architect approved equal. Anchors detailed on Structural Drawings supersede.
6. At Veneer Brick Anchored to Light Gauge Steel Framing: Hot-dipped galvanized, 2 Seal Tie System utilizing self-tapping screw for steel studs with 5/8 inch barrel length, and 4 inch triangle wire tie for 2 inch cavity manufactured by Hohmann & Barnard, Inc. or Architect approved equal. Anchors detailed on structural drawings supersede. Attachment screws shall be corrosion resistant type as recommended by manufacturer to suit application. Adjust wire tie size as required to conform with cavity depth if other than 2 inch.
7. Control Joint Anchor: Equal to Hohmann & Barnard, Inc.
8. Corrugated Wall Tiles: Not acceptable under any circumstances.

PART 7 - PRECAST CONCRETE U-LINTELS

1. Concrete Materials:
   a. Portland Cement: ASTM C150 Type I or III, gray color.
   b. Aggregates: ASTM C33.
   c. Water: potable
   d. Admixtures: Shall not contain calcium chloride or chloride ions

2. Reinforcing:
   a. Deformed Reinforcement: ASTM A615 Grade 40 or 60.
   b. Prestressing Strand: ASTM A416 270 ksi LL.

3. Fabrication:
   a. Unless specified otherwise, conform to PCI MNL-116.
   b. U-lintel units 14 feet in overall length and shorter shall be made of concrete with a minimum strength of 3500 psi at 28 days.
   c. U-lintel units exceeding 14 feet in overall length shall be made of concrete with a minimum strength of 6000 psi at 28 days and shall be prestressed concrete.
   d. Units shall be sand block finish except prestressed, 6 inch wide, and 12 inch wide U-lintels shall be smooth form finished.
   e. Tolerances shall be per PCI MNL-116
   f. Minor patching in plant is acceptable provided structural adequacy of units is not impaired

4. Acceptable Product/Manufacturer: Cast-Crete High Strength Precast Concrete U-lintels as manufactured by Cast-Crete, Tampa, FL (800) 999-4641, and locally distributed by Headwaters, (713) 365-9077.

PART 8 - BLOCK INSULATION:

1. Rigid Core Inserts:
   a. Type: “U” shaped insulation inserts conforming to ASTM C578, replacing Federal Specification (FS) HH-I-524C, Type I, specification for Preformed Cellular Polystyrene Thermal Insulation.
   b. Sizes: As required for 6 inch, 8 inch, 10 inch, and 12 inch blocks as shown or required.
   c. Approved Product/Manufacturer: Korfil Insulation Inserts manufactured by Concrete Block Insulating Systems (CBIS), West Brookfield, MA; (800) 628-8476, or Architect approved equivalent.

2. Loose Core Fill: Loose perlite or vermiculite insulation conforming to ASTM C332, Standard Specification for Lightweight Aggregates for Lightweight Concrete, such as Zonolite manufactured by Siplast, Irving, TX; (800) 922-8800, or Architect approved equivalent. Loose fill insulation shall be certified asbestos-free.
3. Foamed-In Place Block Insulation:
   a. Type: Two (2) component system consisting of amino-plast resin and a catalyst foaming agent surfactant.
   b. Features:
      1) Designed to completely fill irregular or hard-to-reach spaces.
      2) Can be installed in both new and existing concrete masonry unit construction.
      3) Excellent energy and sound insulation values.
      4) No settling or expansion after installation.
      5) Superior fire and safety performance.
      6) No CFC’s or HFC’s.
      7) Safe for the environment.
      8) Approved Products/Manufacturers: “Core-Fill 500” manufactured by Tailored Chemical Products, Inc., Longview, TX; (800) 256-3626, Core Foam Masonry Foam Installation by CfiFoam; (434) 546-3632 or Architect approved equivalent.

PART 9 - MISCELLANEOUS MATERIALS: (AS SHOWN OR REQUIRED)

1. Reinforcing Steel: ASTM A615, Grade 60.

2. Forms: Form grade plywood with wood studs and wales as required.
3. Shores: Patented shores of design and manufacture sufficient to safely support imposed loads.
4. Premolded Filler: Fibrous mastic strips containing 35 percent to 50 percent asphaltic impregnation, ASTM D1751.
5. Flashing Cement: "Nerva-plast" cold setting mastic manufactured by Nervastral, Inc., or Architect approved equal.
6. Building Felt: No. 15 asphalt saturated felt, ASTM D226.
7. Dovetail Anchors: 16 gauge galvanized dovetail corrugated masonry anchor, 1 inch x 3-1/2 inch manufactured by Heckman Building Products, Inc., Hohmann & Barnard, Inc., Masonry Reinforcing Corporation of America, or Architect approved equal.
8. Steel Shapes and Plates: As shown on drawings and specified in Section 05 50 00, Metal Fabrications.
9. Headed Stud Anchor: Welded by full-fusion process as furnished by TRW Nelson Stud Welding Division, or Architect approved equal.
10. Bolts: ASTM A307. Furnish with carbon steel washers.
11. Deformed Bar Anchors: Welded by full-fusion process as furnished by TRW Nelson Stud Welding Division, or Architect approved equal.
12. Reinforcing Bars to be Welded: ASTM A706.
13. Flashing: Reference Division 07.
14. Cavity Drainage Protection: 2 inch thick by 10 inch high by 5 feet long recycled polyester/ polyethylene mesh, trapezoidal-shaped, continuous at foundation, at heads above openings, and shelf angles as indicated on drawings. Provide Mortar Net™ manufactured by Mortar Net Solutions, Burns Harbor, IN; (800) 664-6638, or Architect approved equal.
15. Masonry Color: Iron oxide pigment conforming to ASTM C979 in color(s) selected by Architect, shall be inert, stable to atmospheric conditions, sunfast, weather resistant, alkali resistant, water insoluble, and free of fillers and extenders, as manufactured by ChemSystems, Inc., Davis Colors, Solomon Grind-Chem Service, Inc., or Architect approved equal.
16. Weep Hole Vents: Injection molded vent made from flexible polyvinyl chloride in an offset "T" shape, inserted in head joints, the slotted leg of the vent allows air to pass in and out allows water to weep out and prevents water from penetrating in manufactured by Williams-Goodco, Phone: 800-521-9594 or 248-643-6400 or Email: Wilpro@williamsproducts.net. Weep hole vents shall be sized to match masonry (may require custom sizing).

2.3 MASONRY STRENGTH

A. Ultimate compressive strength of masonry as required by design and determined by prism tests shall not be less than 2,500 psi, unless stated otherwise in Structural Drawings.

2.4 MASONRY CLEANING MATERIALS

A. Detergent Cleaner: Follow manufacturer’s instructions.

B. Proprietary Acidic Cleaner: Cleaner designed for removing mortar/grout stains, efflorescence, and construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.
      b. PROSOCO, Inc.
      c. AHI Supply.
      d. NMD80 as manufactured by EachoChem.

C. The following products based on AHI Supply TexClean products are intended as a guide only and does not preclude the contractors use of equal products by listed manufacturers. Consult manufacturer prior to application for any questions or inconsistencies.

Substrate	Color/Type	Cleaning Solution
Brick	Red	Tex Clean Masonry Cleaner
	Light	Tex Tral Masonry Cleaner
	Dark	Tex Tral Masonry Cleaner
	Pavers	Tex Clean Masonry Cleaner
	Glazed	Tex Tral Masonry Cleaner
CMU	Split Face	Tex Tral Masonry Cleaner
	Burnished/Ground Face	Tex Tral Masonry Cleaner
Architectural Concrete	Natural Color/Smooth	Tex Tral Masonry Cleaner
	Textured	Tex Clean Masonry Cleaner
Stone Construction	Cast Stone	Tex Tral Masonry Cleaner
	Arriscraft	Tex Tral Masonry Cleaner
	Limestone (Unpolished)	Tex Tral Masonry Cleaner

PART 3 - EXECUTION

3.1 FORMS AND SHORES

A. Provide forms and shores sufficiently strong and rigid as required to support soffits, beams, and lintels during construction.

B. Build forms to conform to shape, line, and dimension of masonry members as detailed, substantial and sufficiently tight to prevent leakage of mortar, grout or concrete. Properly brace or tie together so as to maintain position and shape.

3.2 PREPARATION OF MATERIALS

A. Concrete Masonry Units:
1. Where cutting is required, masonry shall be cut with a sharp masonry saw.
2. Ensure concrete masonry units to receive sand fill are ready for filling and cutouts are protected from material spillage.

B. Brickwork: Dampen brick before laying in a manner consistent with the nature of the brick, the mortar, and the weather conditions.

C. Mortar and Grout:
1. Use suitable containers for material measurement. Measuring sand by the shovel is not acceptable.
2. Thoroughly machine mix a minimum of five (5) minutes after all materials are in mixer.
3. Consistency will completely fill all spaces intended to receive grout.
4. Use within 2-1/2 hours of initial mixing.
5. Mortar or grout shall not be used if curing has progressed to yield a stiff consistency.

D. Reinforcement:
1. Reinforcement shall be free from loose rust and other coatings that would reduce the bond.
2. Cut accurately to length and bend by such methods as will prevent injury to the material.
3. Straighten out kinks or bends.

E. Flashing:
1. Locations: Install in exterior walls to divert moisture within walls to exterior surfaces.
2. Bed Joints: Coordinate Work with Division 4, Masonry. Install flashings between two (2) thin layers of masonry mortar without increasing thickness of mortar joint. Keep outer edge of flashing material back from face of masonry.
3. Adjacent Work: Protect Work by masking, covering, or other precautionary methods. Remove protection when no longer necessary.
4. Separate copper flashing from dissimilar materials.
5. Protect membrane flashing from overexposure to direct sunlight.

3.3 INSTALLATION

A. General:
1. Do not use chipped or cracked concrete masonry units (CMU) and face brick, where exposed to view.
2. Use masonry saws to cut and fit exposed units.
3. Exposed masonry at exterior corners shall be solid units.
4. Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing material.
5. Place through-wall flashing as follows:
   a. Place on bed of mortar and cover with mortar.
   b. Provide at steel columns and beams in exterior masonry walls and elsewhere as indicated on the drawings or required.
   c. Install asphalt laminated copper membrane as base flashing at all exterior cavity walls below weep holes.
   d. Install at material transitions inside exterior cavity walls, roof edge/exterior wall transitions, masonry joints (control/expansion) inside exterior cavity walls, exterior wall sill/weep conditions, exterior door and window frame perimeters, roof deck/exterior wall transitions, exterior wall penetrations (i.e. pipe, conduit, ducts, etc.). Provide membrane at all joints, holes, gaps or openings to ensure a continuously sealed building envelope.
6. Lay masonry units plumb, true to line, and with level courses accurately spaced within allowable tolerances.
7. Do not furrow bed joints.
8. Stop off horizontal run by racking back in each course; toothing is not permitted.
9. Adjust units to final position while mortar is soft and plastic.
10. If units are displaced after mortar has stiffened, remove, clean joints and units and re-lay with fresh motor.

11. When joining fresh masonry to set or partially set masonry:
    a. Remove loose masonry units and mortar
    b. Clean and lightly wet exposed surface of set masonry prior to laying fresh mortar.

B. Metal Door Frames: Fill jamb frames solid with mortar. Build in anchors.

C. Lintels and Bond Beams: Provide reinforced unit type, except where steel lintels are shown. Use reinforcing bars as shown on the drawings. Completely fill in lintel block and bond beams with grout. Provide 8 inch bearing at end of lintels.

D. Corners: Connect corners with No. 9 galvanized wire tie using one tie for each 4 inches of nominal wall thickness.

E. Partition Tops: Allow space at top of horizontal spanning walls for compressible joint back-up and sealant as specified in Sealant section. Anchor top of walls to deck or structure.

F. Mortar Beds:
1. Place mortar in a manner which will result in the development of adequate bond between the masonry and the reinforcement.
2. Lay units with full mortar coverage on horizontal and vertical joints in all courses.
3. Provide sufficient mortar on ends of masonry unit to fill head joints.
4. Rock closures into place with head joints thrown against two adjacent masonry units in place.
5. Do not pound corners or jambs to fit stretcher units after setting in place.
6. Where adjustment to corners or jambs must be made after mortar has started to set, remove mortar and replace with fresh mortar.

G. Mortar Joints and Patterns:
1. Lay CMU in running one-half (1/2) bond pattern, unless noted otherwise.
2. Lay brick in running one-third (1/3) bond pattern, unless noted otherwise on drawings. Refer to drawings for accent coursing.
3. Provide flush joints where concealed from view and where dampproofing is scheduled.
4. Provide standard concave tooled joint where masonry is exposed to view for brick and CMU, typically.
5. All mortar joints to be of consistent size.
6. Provide soldier courses where indicated, refer to the elevations.
7. All horizontal joints shall be concave tooled joint at face of units, unless noted otherwise.
8. Provide raked joints at all exposed burnished cmu locations.

H. Reinforcement, Anchor and Tie Systems:
1. General:
    a. Completely embedded in mortar or grout.
    b. All reinforcement consisting of bars or wire 1/4 inch or less in diameter embedded in the horizontal mortar joints shall have no less than 5/8 inch mortar coverage from the exposed face.
    c. Where modular brick is used with brick coursing at 16 inches on center, provide ladder reinforcing within each wythe at 16 inches o.c. vertically for exterior wythe and back-up wythe, whether detailed or not. For other than modular brick, refer to Paragraph h. below.
    d. Veneer anchors at exterior sheathed covered metal stud exterior walls shall be attached on outside face of sheathing using cadmium plated sheet metal screws. Spacing shall be same as stud spacing o.c. horizontally and 16 inches o.c. vertically.
    e. Veneer anchors at Interior brick walls with metal stud back-up shall be the same as Paragraph “d” above, except anchors shall be attached directly to metal stud

with recommended corrosion resistant fasteners in accordance with manufacturer's recommendations.

f. At intersection of all perpendicular masonry walls provide two (2) vertical rows of ladder type reinforcing at 16 inches o.c. vertically. Refer to Structural Drawings for details on shear walls.

g. Weld veneer anchors to structural steel in accordance with manufacturer's recommendations. Touch-up steel shop paint and galvanized coating on anchor with touch-up primer and finish coats to match damaged coating in accordance with manufacturer's recommendations.

h. In cavity walls with CMU back-up, embed truss type horizontal reinforcement with integral adjustable pintle wall ties every 16 inches o.c. vertically.

i. Splices in reinforcement: Splices may be made only at such points and in such manner that the structural strength of the member will not be reduced. Lapped splices shall be eight (8) inches. Welded or mechanical connection shall develop the strength of the reinforcement.

j. Corrugated strap ties shall not be used as veneer anchors at exterior or where subject to moisture. Their use in interior, dry conditions are acceptable.

k. Place joint reinforcement in the first two (2) bed joints above and the first two (2) bed joints below masonry openings. Extend extra reinforcing two (2) feet beyond jambs.

l. Provide masonry ties at floor and roof decks as indicated.

I. Flashing:

1. Follow manufacturer's instructions for mechanically fastened installation with a termination bar.
2. Application Guidelines - Install flashing at the following locations:
   a. Membrane Flashing: material transitions inside exterior cavity walls, roof edge/exterior wall transitions, masonry joints (control/expansion) inside exterior cavity walls, exterior door and window frame perimeters, roof deck/exterior wall transitions, exterior wall penetrations (i.e. pipe, conduit, ducts, etc.). Provide membrane at all joints, holes, gaps, or openings to ensure a continuously sealed building envelope. Utilize primer on substrates as instructed by manufacturer.
   b. Copper Flashing: At all horizontal wall flashing, including (but not limited to) exterior wall sill/weep conditions, exterior door and window head/weep conditions, masonry wall cap flashing and masonry wall base flashing.
3. Apply substrate primer as instructed by membrane manufacturer to suit condition.
4. Provide drip edge flashing at weep conditions with membrane flashing. Cut membrane flush with outside edge of brick over top of drip edge flashing to alleviate exposure to UV degradation and deterioration of asphalt membrane.
5. On Horizontal Surfaces: The flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. The flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches. Flashing will then be secured in back wall with termination bar.
6. On Vertical Surfaces: Surfaces receiving the flashing shall be sufficiently spotted with asphalt mastic to hold in place until masonry is set. Secure in back wall with termination bar.
7. Foundation Sill Dampproofing: The flashing for foundation sills shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. The flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be sloped across the cavity and turned up the wall a minimum of ten (10) inches and secured to back wall with termination bar. Where sill and column meet, flashing shall be brought up a minimum of ten (10) inches up the column.

8. Thru-Wall Flashing: Shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Carry flashing through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secure in back wall with termination bar.
9. Cavity Wall: Flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secured in the back wall with termination bar. Vertical membrane joints shall be secured with termination bar as instructed by membrane manufacturer.
10. Heads and Sills: Flashing for heads and sills shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise. Head flashing shall be carried six (6) inches beyond both end of the steel lintel. Both head and sill flashing shall be turned up at the sides to form a pan. All corners shall be folded, NOT CUT. Install weepholes.
11. Spandrels: Spandrel flashing shall start from the outside toe of the shelf angle, go up the face of the beam and then through the wall, turned up on the inside not less than two (2) inches. Install weepholes.
12. Parapet or Coping: Flashing for parapets or coping sills shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut flush with the exterior face of the wall after being left exposed for inspection purposes only. Weepholes shall be installed immediately on top of the flashing.
13. Lengths: Install flashings without longitudinal joints within walls, if possible. If required materials are not available in a single width, join by lapping material minimum two (2) inches and seal joint throughout its length with adhesive.
14. End Joints: Avoid end joints in flashing. When end joints are necessary, lap flashing minimum six (6) inches and seal joint continuously with adhesive.
15. Penetrations: Where anchors, pipes, and inserts penetrate flashing, make opening in flashing snug and seal with adhesive.
16. Reglet Termination: Insert wedge into place and seal carefully with adhesive
17. Termination Bar: Install flashing with termination bars in accordance with manufacturer's instructions. Provide 3 coursing at all termination bars, typical.
18. Top Coat: After flashing material is in place (except in masonry joints where bond and mortar is required) trowel full 1/8 inch protective coating or mastic on all flashing faces.

J. Laying Masonry: Lay units plumb, level, and true to line with full head and bed joints. Butter ends of masonry with sufficient mortar to fill head joints. Do not furrow bed joints. Slope top of bed joint toward center of wall to minimize amount of mortar forced into grout space. Remove mortar, protruding from joints into grout space, before pouring grout.

K. Reinforcing Bars:
1. Hold vertical bars in position at top and bottom and at intervals not exceeding eight 8 feet-0 inches with a minimum clearance of 1/4 inch from masonry and not less than one (1) bar diameter between bars.
2. When a foundation dowel is not in alignment with a vertical block cell or pilaster, slope it not more than one (1) horizontal in six (6) vertical to bring it into proper alignment before grouting.
3. Place horizontal reinforcing bars in continuous masonry courses, consisting of bond-beam or trough block units, and solidly grout in place.
4. Use straight reinforcing bars except for bends around corners and where bends or hooks are detailed on plans.
5. Lap reinforcing steel 40 bar diameters minimum where spliced and wire together.

L. Grouting: Where detailed place grout in reinforced masonry beams, walls, columns, and pilasters. All cells and spaces containing reinforcing bars shall be filled with grout. Wherever possible grouting shall be done from inside face of masonry. Exercise extreme care to prevent grout from staining face of masonry. Immediately remove any spilled grout from face and top of masonry.

1. Prior to grouting clean space so that all spaces to be filled with grout do not contain mortar projections greater than 1/2 inch, mortar droppings or other foreign material. Grout shall be placed so all spaces designated to be grouted shall be filled with grout and grout shall be confined to those specific spaces.
2. Grout materials and water content shall be controlled to provide adequate fluidity for placement, without segregation of constituents and shall be mixed thoroughly.
3. Between grout pours a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with grout stopping a minimum of 1-1/2 inches below a mortar joint, except at top of wall. Where bond beams occur, stop grout pour a minimum of 1/2 inch below top of masonry.
4. Reinforcement shall be placed prior to grouting. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent movement.
5. Segregation of grout materials and damage to masonry shall be avoided during the grouting process. Adequately brace masonry to prevent displacement or cracking during grouting operations.
6. Grout shall be consolidated by mechanical vibrator during placing, before loss of plasticity, in a manner to fill grout space. Grout pours greater than 12 inches shall be reconsolidated by mechanical vibration to minimize voids due to water loss. Grout pours 12 inches or less in height shall be mechanically vibrated, or puddled.
7. Grout shall not be handled nor pumped utilizing aluminum equipment.
8. Size and height limitations of grout space or cell shall be as follows:

GROUT TYPE	GROUT POUR MAX. HEIGHT (FEET)	LEAST CLEAR DIMENSIONS		CLEANOUTS REQUIRED
		Width of Grout Space (In.)	CMU Cell Dim. Dims. (In. x In.)	
Fine	1	3/4	1-1/2 x 2	No
Fine	5	1-1/2	1-1/2 x 2	No
Fine	8	1-1/2	1-1/2 x 3	Yes
Coarse	1	1-1/2	1-1/2 x 3	No
Coarse	5	2	2-1/2 x 3	No
Coarse	8	2	3 x 3	Yes

   a. Clear dimension is the cell or grout space width less mortar projections.
   b. Grout space width shall be increased by the horizontal projection of the diameters of horizontal bars within the cross section of the grout space.

9. Place grout in lifts not exceeding 8 feet-0 inches.

M. Concreting: Supervise placing of concrete in cores of masonry beams and lintels and over masonry soffits where structural concrete is detailed. Report discrepancies or procedures which may adversely affect performance of masonry Work.

N. Brick Weep holes:

1. Provide weep holes above all thru-wall flashings where weep holes occur at the base of the wall. The mason shall coordinate the location of the thru-wall flashings with the location of the sidewalks on the civil engineering drawings. All weep holes shall be at

least one course below finished floor or at the first course of brick above the sidewalks. Pay particular attention to areas near exterior doors.

2. Ensure cavity drainage protection is properly installed.
3. Leave head joint free and clean of mortar.
4. Spacing: 20 inches on center maximum for king sized brick, and 24 inches on center for modular brick and block, unless shown otherwise.
5. Keep weep holes and area above flashing free of mortar droppings.
6. Coordinate weep holes to be located above sidewalks and paving.

O. Sealant Joints:
1. Allow for sealant joints around outside perimeters of exterior doors, window frames and other wall openings.
2. Uniform depth: 3/4 inch.
3. Uniform width: As shown on the drawings but not less than 1/4 inch.
4. Provide sample for Architect's approval.
5. Refers to drawing for locations and details of accent joints.

P. Movement Joints (Expansion Joints and Control Joints):
1. Locate expansion and control joints as shown on drawings, or if not shown, comply with the following:
   a. General:
      1) Vertical expansion joints shall be placed in the brick wythe and control joints shall be placed in the concrete masonry wythe, although they do not necessarily have to be aligned.
      2) Mortar and joint reinforcement shall not bridge brick movement joints.
      3) Mortar joints which stop at the expansion joint cavity shall be struck flush with the masonry unit, producing a continuous flat surface for the sealant to adhere to.

   b. Vertical Expansion Joints:
      1) Locate expansion joints on long straight walls without openings maximum 25 feet-0 inches.
      2) Locate expansion joints at the corner of walls perpendicular to one another. In instances, where the joint is not desired at the corner, the expansion joint shall be located within 10 feet-0 inches of the corner in either wall, but not necessarily both. The spacing of expansion joints around a corner shall not exceed the spacing of expansion joints in a straight wall. For example, if the spacing between expansion joints on a straight wall is 25 feet-0 inches, then the spacing of expansion joints around a corner could be 10 feet-0 inches on one side of the corner and 15 feet-0 inches on the other side. Joint reinforcement may be added around wall corners to provide added tensile strength to the corner, but joint reinforcement shall not bridge the expansion joint.

   c. Offsets and Setbacks:
      1) Locate expansion joints at 10 feet-0 inches maximum on one side of the offset or setback. The spacing of expansion joints around an offset or setback shall not exceed the spacing of expansion joints in a straight wall. See expansion joints at corners of perpendicular walls to one another above for example of spacing.

   d. Openings (Doors and Windows):
      1) Locate vertical expansion joints along the edge or jamb of the opening of windows and doors. Single opening windows and doors under 6 feet-0 inches in width shall have expansion joint on one (1) side of the edge or jamb of the opening as determined by the Architect, unless shown

otherwise on drawings. Windows and doors 6 feet-0 inches and over in width shall have expansion joints on both sides of the edge or jamb of the opening.

2) Where masonry above an opening is supported by shelf angles attached to the structure, a vertical expansion joint shall be located alongside the opening, continuing through the horizontal support.

3) Where masonry above the opening is supported by loose lintels (unattached to the structure), special detailing and construction is required. If the expansion joint runs along side the opening, the loose steel lintel shall be allowed to expand independently of the masonry. To accomplish this, form a slip plane with flashing located above and below the angle. A backer rod and sealant shall be installed in front of the toe of the angle, and space shall be left at the end of the angle. Thus, a pocket will be formed which will allow movement of the steel angle within the brickwork. If the joint cannot be built in this manner, then the vertical expansion joint shall not be located alongside the opening, but rather, with Architect's prior approval, the joint shall be located halfway between the openings.

e. Intersections and Junctions:

1) Locate expansion joints at intersections of masonry walls and walls which serve different functions. If the masonry is not required to be bonded at the intersection, an expansion joint shall be incorporated. Walls which intersect at other than right angles are also vulnerable to cracking at the intersection.

2) Locate expansion joint to separate adjacent walls of different heights to avoid differential movement, especially if the difference is very large.

f. Parapets:

1) All vertical expansion joints shall be carried through the parapets.

2) Additional expansion joints shall be halfway between those running full height, unless the parapet is reinforced. These additional expansion joints shall continue down to a horizontal expansion joint, or continue to the base of the wall.

g. Horizontal Expansion Joints:

1) Locate horizontal expansion joints at shelf angles supporting brick masonry.

h. Control Joints:

1) Locate CMU control joints directly over concrete slab control joints.

2) Whenever possible, lay out CMU so that control joint will coincide with CMU module (25 feet-0 inch maximum spacing between control joints), unless noted otherwise on drawings.

3) Locate control joints at structural columns to isolate movement from continuing or intersecting walls and columns.

4) Install backer rod and sealant in accordance with manufacturer's instructions.

3.4 ALLOWABLE TOLERANCES

A. Maximum Variation from Plumb:

1. In lines and surfaces of columns, walls and at rises:

a. 1/4 inch in 10 feet (1:480).

b. 3/8 inch in 20 feet (maximum).

c. 1/2 inch in 40 feet (1:960).

2. For external corners, expansion joints and other conspicuous lines:
   a. 1/4 inch in 20 feet (maximum).
   b. 1/2 inch in 40 feet (1:960).

B. Maximum variation from level:
   1. 1/4 inch in any bay or 20 feet.
   2. 1/2 inch in 40 feet (1:960).

3.5 REMOVAL OF FORMS AND SHORES

A. Do not remove shores and forms under reinforced masonry beams, lintels, and soffits until members have hardened sufficiently to carry their own weight and other super imposed loads. Providing that sufficient curing has taken place, leave forms and shores in place as follows:
   1. Beam and lintels: Minimum ten (10) days.

B. Allow 16 hours to elapse after completion of masonry columns and walls before placing floor or roof construction loads on them. Allow an additional 48 hours before applying concentrated loads such as trusses, girders, and beams.

3.6 REPAIRING, POINTING AND CLEANING

A. All holes in exposed masonry shall be pointed, and defective joints shall be cut out and re-pointed with mortar.

B. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 20 square feet, in a location approved by Architect. No further cleaning Work may proceed until the sample area has been approved by Architect, after which, the same cleaning materials and method shall be used on remaining wall area. Sash, metal lintels and other corrodible parts shall be thoroughly protected.
Clean all exposed surfaces of new masonry of excess mortar, efflorescence, stains, and job dirt, using materials specified.
   1. Clean from bottom up; prevent cleaning materials and rinse water from contacting non-cementitious materials.
   2. Clean in accordance with manufacturer's instructions and recommendations, product data, and container label instructions.
   3. Mix materials in strict accordance with manufacturers instructions; do not dilute unless permitted by manufacturer.
   4. Prevent overspray, wind drift, and splash onto surfaces not to be treated.
   5. No high pressure washers are permitted.
   6. Low pressure spray for wetting and rinsing is permitted. Pressure should be in the range of 400-1000 psi. Equipment should produce 6-8 gallons of water per minute using a 15-40 degree fan tip (no fan tip less than a 15 degree is allowed).
   7. No metal tools or wire brushes are allowed for cleaning of masonry. Use a waste piece of same masonry material for scraping of installed material.

3.7 REPAIR OR REPLACEMENT OF DAMAGED WORK

A. Imperfect or damaged Work, or any material damaged or determined to be defective before final completion and acceptance of the entire job, shall be satisfactorily replaced at Contractor's expense and in conformity with all requirements of drawings and specifications. Removal and replacement of masonry Work shall be performed in such a manner as not to impair the appearance or strength of the structure in any way.

3.8 CLEAN-UP AND PROTECTION

A. Clean up all debris caused by Work of this Section, keeping the area clean and neat at all times.

B. Cover all unfinished Work at night against the elements with plastic sheeting, building paper, heavy canvas or other material approved by Architect to prevent water from entering cavities.

C. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.9 FIELD QUALITY CONTROL AND TESTING

A. Inspection and Testing Laboratory services shall be in accordance with Section 01 45 23, Testing and Inspecting Services.

END OF SECTION 04 20 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Mortar and grout.
   3. Steel reinforcing bars.
   4. Masonry joint reinforcement.
   5. Ties and anchors.
   6. Embedded flashing.
   7. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
   1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
   2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
1. Decorative CMUs, in the form of small-scale units.
2. Pre-faced CMUs.
3. Colored mortar.
4. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:
1. CMUs.
2. Accessories embedded in masonry.

1.7 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:
1. Masonry units.
   a. Include material test reports substantiating compliance with requirements.
   b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for each type of unit masonry construction in sizes approximately 48 inches long by 48 inches high by full thickness.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

F. Mortar Cement: ASTM C 1329.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

H. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints, less than 1/4-inch-thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.

L. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter or as indicated on Drawings.
4. Wire Size for Cross Rods: 0.148-inch diameter or as indicated on Drawings.
5. Wire Size for Veneer Ties: 0.148-inch diameter or as indicated on Drawings.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units].

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
   2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
   3. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
   2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, steel sheet, galvanized after fabrication.
   2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch-diameter, hot-dip galvanized steel.
   3. Corrugated Metal Ties: Metal strips not less than 7/8-inch-wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.075-inch-thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.

D. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4-inch-thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
   1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153] [Epoxy coating 0.020 inch thick.

2.7 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of dimensions indicated.

B. Post-installed Anchors: Torque-controlled expansion anchors or chemical/adhesive anchors unless otherwise indicated on Drawings.
   1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as indicated on Drawings. Include accessories, adhesives, primers, and seam tapes as applicable.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812, or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. For reinforced masonry, use Portland cement-lime mortar.

3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or] paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi except where indicated on Drawings.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2-inch or minus 1/4-inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2-inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4-inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch or minus 1/4-inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond, unless otherwise indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches or less on center unless otherwise indicated.
   3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
   4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Allow cleaned surfaces to dry before setting.
   3. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8-inch on exterior side of walls, 1/2-inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING

A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
   4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
   5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.

6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

G. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 04 73 13 – CALCIUM SILICATE MANUFACTURED STONE MASONRY

1.01 SECTION INCLUDES

A. Design Services: Provide a Proprietary Design/Build Thin Calcium Silicate Unit, modified curtain wall cladding system for project use which includes all materials and labor as required to provide a completed system including, but not limited to the following:

1. Design, Coordinate, and provide the Precision Walls System's proprietary aluminum anchor installation system complete with all anchors, sealants, and components as required for a complete installation that is watertight and designed to withstand applicable building code wind loads.

2. Provide the services of a registered structural engineer in the State of Texas, to provide engineering approval for the system in the form of a system suitability review and compliance document. This project specific document will include an evaluation of wind pressures, anchoring system dead load and fastener pull out analysis. Subject compliance document will be signed and stamped by a registered structural engineer in the State of Texas.

1.02 DESIGN REQUIREMENTS:

A. The Gridworx extruded aluminum channels are a design/build system. The anchors and stone are designed to attach to the substrate at 16" centers. Precision Wall Systems, Inc. is responsible for providing engineering approval for the system. Engineering for the exterior building wall support system is the structural engineer of record's responsibility.

B. The Thin Calcium Silicate Unit veneer shall be anchored at spacings to meet all Building Codes governing this project, including wind load requirements and wind pressures design loads as required

1.03 PRODUCT DATA

A. Submit manufacturers data sheets for the extruded aluminum channels, Thin Calcium Silicate Units, weep vents, and sealant materials.

1.04 SHOP DRAWINGS

A. The Gridworx mechanical stone hanging system is a thin stone cladding system. Generally, the Thin Calcium Silicate Units will be delivered to the job site in standard sizes. Field modifications are required to incorporate this system with actual project conditions and the architect's design elements. As such, the installer should be familiar with these elements thereby relieving the necessity of submittal drawings.

1.05 MOCKUPS

A. Construct mockup of Thin Calcium Silicate Units to requirements of Section 01001.

B. Construct typical mockup panel 48" x 48" to illustrate units, coursing, sealant joints, and extruded aluminum support channels.

C. Construct mockup to illustrate backup wall, exterior sheathing, air barrier, moisture barrier wall insulation, weep vents, and through wall flashing.

D. Mockup may remain part of the finished Work.

E. The approved jobsite mockup panel shall be used to determine the level of workmanship expected on the buildings veneer installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver Thin Calcium Silicate Units to the site in approved protective film. Prevent damage to units.

B. Lift skids with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.

C. Store units in a manner designed to prevent damage and staining of units.

D. Stack units on timbers or platforms at least 3” above grade.

E. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.

F. Cover stored units with protective enclosure if exposed to weather.

G. Do not use salt or calcium-chloride to remove ice from unit surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers of Thin Calcium Silicate Units having Products considered acceptable for use: Arriscraft International Inc., as distributed by Upchurch Kimbrough Company; *ARRIS▪clip Renaissance® Units.* Manufacturers: Must have a minimum of five (5) years experience manufacturing products equal to those specified and comply with requirements of Division 1 regarding substitutions to be considered.

B. Manufacturers of extruded aluminum channels having products considered acceptable for use Precision Wall Systems, Inc., as distributed by Upchurch Kimbrough Company; *Gridworx’s Extruded Aluminum Channels.* Manufacturers: Must have a minimum of five (5) years experience manufacturing products equal to those specified and comply with requirements of Division 1 regarding substitutions to be considered.

2.02 MATERIALS

A. Calcium Silicate Building Stone Units: ASTM C73, Grade SW; solid units that have been pressure formed and autoclaved; special shapes as indicated; two-size configuration; as follows:
   1. Sizes: Building Stone
      1. Field (CSMU1): 2-3/8 inch high, 3-7/8 inch bed, various lengths up to 23-5/8 inch.
      2. Accent (CSMU2): 2-3/8 inch high, 3-7/8 inch bed, various lengths up to 23-5/8 inch.
   2. Texture:
      a. Building Stone: split and tumbled finish on exposed faces and ends.
      b. Renaissance Stone: Smooth & Rocked as indicated on drawings.

3. Color:
   A. Field: Evening Shade.
   B. Accent: Harbor Gray.

4. Finish: Smooth and Tumbled as indicated on Drawings.

B. Thin Calcium Silicate Units: to ASTM C73, Grade SW; solid units having been pressure formed and autoclaved; 1-3/8” bed depth; modular sizes as indicated on drawings smooth finish on exposed faces; special shapes as indicated; color as selected by Architect.

1. Arris.Clip to be used on canopy entrance as indicated on drawings.

C. Fabricate anchors from extruded aluminum alloy and temper as required to support loads imposed without exceeding allowable design stresses, but not less than strength and durability properties of Alloy 6005-T5.

D. Threaded Fasteners:

1. Steel stud frame fasteners shall be #12 Hex-head Drill flex fasteners or suitable alternate.
2. Concrete or CMU block substrate will require 3/16” Tap-con or other comperable concrete screw.
3. Wood frame studs will require #12 Hex-head stainless steel screws.

2.03 ACCESSORIES

A. Flexible Flashing: Refer to Section 04 20 00.

B. Weep Vents: Refer to Section 04 20 00.

C. Shims - Full bearing (3” or greater vertical dimension) hi-impact resistant plastic shims.

D. Sealant for joints - Low modulus silicone expansion joint sealant meeting ASTM 719, SWRI validation and manufacturer’s 20-year weather seal warranty such as Dow Corning 790. Prior to installation of the low modulus silicone joint sealant, installer should contact the sealant manufacturer for proper application and compatibility guidelines.

2.04 FABRICATION TOLERANCES

A. Fabricate Thin Calcium Silicate Units to the following tolerances:

1. Unit Length: plus or minus 1/16".
2. Unit Height: plus or minus 1/16".
3. Deviation From Square: plus or minus 1/16", with measurement taken using the longest edge as the base.
4. Bed Depth: plus or minus 1/8".
5. Custom Dimensions: plus or minus 1/8".
6. Unit Face Deviations: plus or minus 3/8”.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive Work.

B. Beginning of installation means acceptance of site conditions.

3.02 INSTALLATION:

A. The Gridworx extruded aluminum channels are a design/build system. Installer will be familiar with the procedures and recommendations and held to the requirements of the Gridworx Mechanical Stone Hanging System Installation Guide furnished by Precision Wall Systems, Inc.

3.03 CUTTING OF THIN CALCIUM SILICATE UNITS

A. Cut thin Calcium Silicate Units with a wet-saw.

B. Pre-soak units using clean water prior to cutting.

C. Clean cut units using a stiff fibre brush and clean water. Allow units to surface dry prior to placement.

D. All Thin Calcium Silicate Units shall be cut accurately to shape and dimensions and full to the square, with jointing as shown on drawings

E. Any miscellaneous cutting and drilling of Thin Calcium Silicate Units necessary to accommodate other trades will be the responsibility of the installer.

F. Incidental cutting such as for window frame clips, etc., which is normally not considered to be the responsibility of the Thin Calcium Silicate Unit supplier, will be provided only by arrangement by the contractor with the Thin Calcium Silicate Units supplier.

3.04 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain thin masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

C. Place thin masonry units in stack bond.

D. Maintain sealant joint thickness of 3/8".

3.05 TOLERANCES

A. Variation in Alignment from Unit to Adjacent Unit: 1/16" maximum.

B. Variation of Sealant Joint Thickness: 1/8" every 36".

3.06 FLASHING

3.07 Extend flashing under veneer system, turn up structural back-up [under the moisture barrier] and [bed into mortar joint of masonry] [seal to concrete] [seal into sheathing over [wood] [steel stud] framed] back-up.

3.08 Lap end joints and seal watertight.

3.09 INTERFACE WITH OTHER WORK

A. Thin Calcium Silicate Units coming in contact with structural Work shall be back-checked.

B. Thin Calcium Silicate Units resting on structural Work shall have beds shaped to fit the supports as required. Maintain a minimum of 1” clear minimum at metal studs and sheathing board) between stone backs and adjacent structure. (Note: some bolted connections may require more space than this. Subcontractor shall verify and make provision for these conditions.

3.10 CLEANING

A. Clean the Thin Calcium Silicate units as Work progresses.

B. Post-Construction: Clean [a 100 sq. ft. area of wall designated by Consultant] [mock-up panel] as directed below and leave for one week. If no harmful effects appear clean Thin Calcium Silicate Unit Veneer as follows:

1. Protect windows, sills, doors, trim and other Work from damage.

2. Remove large particles with [stiff fiber brushes] [wood paddles] without damaging surface. Saturate thin units with clean water and flush off loose dust and dirt.

3. Scrub with solution of 1 tsp. trisodium phosphate and 1 tsp. household detergent dissolved in 4 cups of clean water using stiff fibre brushes, then clean off immediately with clean water using a hose.

4. Repeat cleaning process as often as necessary to remove any stains.

C. Acids are not permitted without written approval. Protect stonework from rundown or splash when using acid on adjacent materials.

D. Use alternative cleaning solutions and methods for difficult to clean units only after consultation with thin unit manufacturer.

3.11 PROTECTION

A. Protect thin units from damage resulting from subsequent construction operations.

B. Use protection materials and methods which will not stain or damage Thin Calcium Silicate Units.

C. During construction, tops of walls shall be carefully covered at night, and especially during any precipitation or other inclement weather.

D. Remove protection materials upon Substantial Performance of the Work, or when risk of damage is no longer present.

E. At all times, walls shall be adequately protected from droppings.

END OF SECTION 04 20 01

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Structural steel.
2. Prefabricated building columns.

B. Related Sections:
1. Section 01 45 23 "Testing and Inspection Services".
2. Section 05 12 13 "Architecturally Exposed Structural Steel Framing".
3. Section 05 31 00 "Steel Decking".
4. Section 13 34 19 "Metal Building Systems".

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A 6 with flanges thicker than 1 1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 REFERENCES

A. Comply with applicable provisions of the following specifications and documents: The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AISC "Code of Standard Practice for Steel Buildings and Bridges”.
2. AISC "Specification for Structural Steel Buildings," including the "Commentary" and the Supplements thereto, as issued.
3. AISC "Specification for Architecturally Exposed Structural Steel”.
4. AISC's "Seismic Provisions for Structural Steel Buildings”.
5. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use”.

6. AWS D1.1 Structural Welding Code.
7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
8. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
9. SSPC (Steel Structures Painting Council), Painting Manuals, Volumes 1 and 2.
10. UL Fire Resistance Directory.

B. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.5 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
1. Select and complete connections using schematic details indicated and AISC 360.

B. Moment Connections: Type FR, fully restrained.

C. Construction: System as indicated on Drawings.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.
8. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. At full penetration welds, Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
1. Qualification Data: For qualified installer, fabricator, and testing agency.
2. Welding certificates.
3. Mill test reports for structural steel, including chemical and physical properties.

4. Product Test Reports: For the following:
   a. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   b. Direct-tension indicators.
   c. Tension-control, high-strength bolt-nut-washer assemblies.
   d. Shear stud connectors.
   e. Shop primers.
5. Source quality-control reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, or P3 as applicable for exposure or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:
   1. AISC 303.
   2. AISC 341 and AISC 341s1.
   3. AISC 360.
   4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.10 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
1. W-Shapes: 60 percent.
2. Channels, Angles, M, S-Shapes: 60 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 25 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

B. W-Shapes: Refer Structural General Notes.

C. Channels, Angles, M, S-Shapes: Refer Structural General Notes.

D. Plate and Bar: Refer Structural General Notes.

E. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588, Grade 50.

F. Cold-Formed Hollow Structural Sections: Refer Structural General Notes.

G. Steel Pipe: Refer Structural General Notes.
1. Weight Class: See Plans.
2. Finish: Black except where indicated to be galvanized.

H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts.
1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers (All bolts located in Crawl Space): ASTM A 325, Type 1, heavy-hex steel structural bolts.
1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain or Mechanically deposited zinc coating, where required.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, See Anchor Bolt Schedule on Drawings for Grade.
1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish:
   a. General Condition – Plain
   b. Crawl Space - Hot-dip zinc coating, ASTM A 153, Class C.

F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

I. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Amscot Structural Products Corp.
   b. Fluorocarbon Company Limited.
   c. R.J. Watson Bridge & Structural Engineered Systems.
   d. Seismic Energy Products, L.P.
2. Mating Surfaces: PTFE and PTFE or mirror-finished stainless steel.
3. Coefficient of Friction: Not more than 0.05.
4. Design Load: Not less than 5,000 psi .
5. Total Movement Capability: 2 inches.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer (General): Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Primer (Crawl Space Steel): Tnemec Perimeprime Series 394.

D. Galvanizing Repair Paint: SSPC-Paint 20.

2.4 GROUT

A. Refer Section 03 30 00.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in final approved Shop Drawings.
   1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
   2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other effects.
   3. Camber structural steel members where indicated. The camber specified is the camber that is measured in the field with the beam on its side so that the beam weight has no effect. During shipment and handling, cambered members shall be supported in a way that will not result in loss of camber.
   4. Camber tolerance
      a. Beams 50 feet and less; plus or minus 1/2 inch.
      b. Beams greater than 50 feet; plus or minus 1/2 inch, except tolerance can be increased 1/8 inch for each 10 feet or fraction thereof in excess of 50 feet.
      c. Contact engineer for members outside specified camber tolerance. Provide engineer with a list of beam locations and actual measured camber amounts. Submit an engineered shoring plan, if requested, that will allow the beam to deflect to the horizontal position after concrete placement without overloading the framing below.
   5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
   6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.

1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes by burning.

I. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces. Base plates hole sizes for anchor bolts may be oversized to facilitate erection:
1. Bolts 3/4 inch to 7/8 inch diameter: 1/2 inch oversize.
2. Bolts 1 inch to 1 1/2 inch diameter: 3/4 inch oversize.
3. Bolts over 1 3/4 inch diameter: 1 inch oversize.

J. Base Plate Washers: Sizes shall be as follows:
1. 3/4 inch diameter Bolts: 2 inch diameter x 1/4 inch thick
2. 7/8 inch diameter Bolts: 2 1/2 inch diameter x 5/16 inch thick
3. 1 inch diameter Bolts: 3 inch diameter x 3/8 inch thick
4. 1 1/4 inch diameter Bolts: 3 inch diameter x 1/2 inch thick
5. 1 1/2 inch diameter Bolts: 3 1/2 inch diameter x 1/2 inch thick
6. 1 3/4 inch diameter Bolts: 4 inch diameter x 5/8 inch thick
7. 2 inch diameter Bolts: 5 inch diameter x 3/4 inch thick

K. Architecturally Exposed Structural Steel (AESS): Fabricate with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Specification for Architecturally Exposed Structural Steel" for architecturally exposed structural steel.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, Pretensioned, or Slip critical as required or indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8, where required, for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing) excluding crawl space steel. Crawl space steel shall be primed regardless of whether it is to receive fireproofing.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

D. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

E. Crawl space steel to be primed to a DFT between 2.5 and 3.5 mils.

F. Painting: Prepare steel and apply a one-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

G. GALVANIZING

H. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels and shelf angles attached to structural steel frame and located in exterior walls.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Refer Section 01 45 23.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations, to elevations indicated, and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, Pretensioned, or Slip critical as indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 00

SECTION 05 12 13 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes architecturally exposed structural-steel framing.
   1. Requirements in Section 05 12 00 "Structural Steel Framing".

B. Related Sections:
   1. Section 01 45 23 "Testing and Inspection Services".
   2. Section 05 12 00 "Structural Steel Framing".

1.3 DEFINITIONS

A. Architecturally Exposed Structural Steel: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

B. Category 1 AESS: AESS that is within 96 inches (2400 mm) vertically and 36 inches (900 mm) horizontally of a walking surface and is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.

C. Category 2 AESS: AESS that is within 20 feet (6 m) vertically and horizontally of a walking surface and is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.

D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   5. Indicate exposed surfaces and edges and surface preparation being used.
   6. Indicate special tolerances and erection requirements.

B. Samples: Submit samples of AESS to set quality standards for exposed welds for Category 1 AESS.

1. Two steel plates, 3/8 by 8 by 4 inches (9.5 by 200 by 100 mm), with long edges joined by a groove weld ground smooth.
2. Steel plate, 3/8 by 8 by 8 inches (9.5 by 200 by 200 mm), with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches (100 by 150 by 9.5 mm), welded to plate with a continuous fillet weld ground smooth and blended.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and fabricator.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, or P3 as applicable for exposure or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 3, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

2.2 PRIMER

A. Primer: Comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: SSPC-Paint 20.

2.3 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. In addition to special care used to handle and fabricate AESS, comply with the following:
   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
   2. Grind sheared, punched, and flame-cut edges of Category 1 AESS to remove burrs and provide smooth surfaces and edges.
   3. Fabricate Category 1 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
   4. Fabricate Category 1 and Category 2 AESS with exposed surfaces free of seams to maximum extent possible.
   5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
   6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
   7. Fabricate Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
   8. Fabricate Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
   9. Seal-weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates for steel that is designated AESS.

C. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.
   1. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet (6 m) under any lighting conditions.
   2. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch (13 mm).

D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch (3.2 mm) with a tolerance of 1/32 inch (0.8 mm) for Category 1 AESS.

E. Bolt Holes: Cut, drill, mechanically (CNC) thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

F. Cleaning Corrosion-Resisting Structural Steel: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, mechanically (CNC) thermal cut, or punch holes perpendicular to steel surfaces.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.4 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, Pretensioned (TC), or Slip critical as indicated on Drawings.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
   2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
   3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where Category 1 and 2 AESS is exposed to weather.
   4. Provide continuous welds of uniform size and profile where Category 1 and 2 AESS is welded.
   5. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus 0 inch (plus 1.5 mm, minus 0 mm) for Category 1 and Category 2 AESS.
   6. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
   7. At locations where welding on the far side of an exposed connection of Category 1 and Category 2 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
   8. Make fillet welds for Category 1 and Category2 AESS oversize and grind to uniform profile with smooth face and transition.

2.5 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   2. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
   3. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.6 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."

C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
   1. Erect Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
   2. Erect Category 2 and Category 3 AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.

B. Do not use thermal cutting during erection.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, Pretensioned (TC), or Slip critical as indicated on Drawings.

B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.
   1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 and Category 2 AESS.
   2. Remove erection bolts in Category 1 and Category 2 AESS, fill holes, and grind smooth.
   3. Fill weld access holes in Category 1 and Category 2 AESS and grind smooth.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Section 05 12 00 "Structural Steel Framing." The testing agency will not be responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.6 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 13

SECTION 05 21 00 – STEEL OPEN WEB JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. LH- and DLH-series long-span steel joists.
5. CJ-series composite steel joists.
6. Joist girders.
7. Joist accessories.
8. Extended ends.
9. Ceiling extensions.
10. Bearing plates.
11. Bridging.
12. Side wall anchors.

B. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete".
2. Section 01 45 23 “Testing and Inspection Services”
3. Section 04 20 00 "Unit Masonry".
4. Section 05 12 00 "Structural Steel Framing".
5. Section 05 31 13 “Steel Floor Decking”.
6. Section 05 31 23 “Steel Roof Decking”.

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.

B. AWS D1.1 Structural Welding Code

C. SJI “Standard Specification Load Tables and Weight Tables for Steel Joists and Joist Girders”.

D. SDI “Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution”.

E. SSPC Steel Structures Painting Council Painting Manual.

F. UL Fire Resistance Directory.

G. ICBO Product Evaluation Reports.

H. FM Roof Assembly Classifications.

I. In the case of conflict between the Contract Documents and a reference standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support non-uniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.
Review LEED requirements with Project Architect and edit as needed. References to LEED credits below MAY NOT be current.

B. Shop Drawings:
1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.
4. Shop drawings containing special joists shall be submitted with a design load summary for each special joist design. Load summary will be reviewed and returned with the joist submittal. Shop drawings containing special joists submitted without the specified load summary will be returned unchecked as an incomplete submittal. Shop drawings containing special joists shall be signed and sealed by the qualified professional engineer responsible for the design of the joists.

1.6 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
1. Qualification Data: For manufacturer.
2. Welding certificates.
3. Manufacturer certificates.
4. Mill Certificates: For each type of bolt.
5. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

B. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

C. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.9 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and or masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Use ASD; data are given at service-load level.

C. Design special joists to withstand design loads with live-load deflections no greater than the following:
1. Floor Joists: Vertical deflection of 1/360 of the span.
2. Roof Joists: Vertical deflection of 1/360 of the span.

D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

2.2 MATERIALS

A. Steel: Comply with SJI's "Specifications" for chord and web members.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions and Extended Ends: Provide top chord extension or extended ends where shown on plans. Design for load indicated on plans.

E. Camber joists according to SJI's Specifications unless noted otherwise.

F. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on plan.
1. Joist Type: Refer to Drawings.

2. End Arrangement: Refer to Drawings.
3. Top-Chord Arrangement: Refer to Drawings.

B. Provide holes in chord members for connecting and securing other construction to joists.

C. Camber long-span steel joists according to SJI's Specifications unless noted otherwise.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.5 JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specifications for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated on plan.
1. End Arrangement: Refer to Drawings.
2. Top-Chord Arrangement: Refer to Drawings.

B. Provide holes in chord members for connecting and securing other construction to joist girders.

C. Camber joist girders according to SJI's Specifications unless noted otherwise.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.6 PRIMERS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.7 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint for interior exposure or Hot-dip zinc coat according to ASTM A 123/A 123M for exterior or weather exposure.

C. Furnish ceiling extensions (where indicated), either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

D. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
Finish: Plain, uncoated.

E. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers. Finish: Plain.

F. Welding Electrodes: Comply with AWS standards.

G. Galvanizing Repair Paint: ASTM A 780.

H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.8 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 2 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications", "Standard Specifications for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written recommendations, and requirements in this Section.

C. Before installation, splice joists delivered to Project site in more than one piece.
Space, adjust, and align joists accurately in location before permanently fastening.

D. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

E. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

F. Field weld joists to supporting steel bearing plates and framework as indicated on Drawings. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance, and quality of welds, and methods used in correcting welding work.

G. Bolt joists to supporting steel framework using high-strength structural bolts as indicated on Drawings. Comply with Research Council on Structural Connection's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

H. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

3.4 REPAIR AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

C. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.

1. Apply a compatible primer of same type as primer used on adjacent surfaces.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 05 31 13 - STEEL FLOOR DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Composite floor deck.
2. Electrified cellular floor deck.
3. Noncomposite form deck.
4. Noncomposite vented form deck.

B. Related Requirements:
1. Section 01 45 23 “Testing and Inspection Services”.
2. Section 03 30 00 "Cast-in-Place Concrete".
3. Section 05 12 00 "Structural Steel Framing".
4. Section 05 21 00 “Steel Joist Framing”

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 - Structural Welding Code
2. AWS D1.3 – Structural Welding Code – Sheet Steel
3. SDI – Design Manual for Composite Decks, Form Decks, Roof Decks, Cellular Metal Floor Deck with Electrical Distribution.
4. SSPC – Painting Manual
5. UL – Fire Resistance Directory
6. ICBO – Product Evaluation Reports

1.4 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Submit the following informational submittals:
1. Welding certificates.
2. Product Certificates: For each type of steel deck.
3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
4. Power-actuated mechanical fasteners.
5. Evaluation Reports: For steel deck.
6. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
14. CSM Metal Deck

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Galvanized-Steel Sheet: As indicated in Structural General Notes.
   2. Profile Depth: As indicated on plan.
   3. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
   4. Span Condition: Triple span or more.

2.3 ELECTRIFIED CELLULAR FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. CMC Joist & Deck.
   2. Consolidated Systems, Inc.; Metal Dek Group.
   3. Cordeck.
   4. HH Robertson Floor Systems; a CENTRIA company.
   5. Marlyn Steel Decks, Inc.
   6. New Millennium Building Systems, LLC.
   7. Nucor Corp.; Vulcraft Group.
   8. Verco Manufacturing Co.
   9. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

C. Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from single manufacturer.

D. Electrified Cellular Floor Deck: Fabricate steel-sheet cellular floor-deck panels, consisting of a ribbed top section welded to a lower flat-bottom sheet with interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck" in SDI Publication No. 31. Fabricate deck to the minimum section properties, width of panel, number and area of cells per panel indicated, and the following:
   1. Cellular Deck Type: Composite.
   2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
   3. Profile Depth: As indicated on plan.
   4. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated in Structural General Notes.
   5. Span Condition: Triple span or more.
   6. Factory punch holes, of size and arrangement indicated, into each deck cell at preset inserts and header duct locations.

2.4 NONCOMPOSITE FORM DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company.
   2. Canam United States; Canam Group Inc.
   3. CMC Joist & Deck.
   4. Consolidated Systems, Inc.; Metal Dek Group.
   5. Cordeck.
   6. DACS, Inc.
   7. Marlyn Steel Decks, Inc.
   8. New Millennium Building Systems, LLC.

9. Nucor Corp.; Vulcraft Group.
10. Roof Deck, Inc.
11. Valley Joist; Subsidiary of EBSCO Industries, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 80 minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
a. Color: Manufacturer's standard Gray.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 80, G90 zinc coating.
3. Profile Depth: As indicated on Plan.
4. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.5 NONCOMPOSITE VENTED FORM DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.; Vulcraft Group.
8. Roof Deck, Inc.
9. Verco Manufacturing Co.
10. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Vented Form Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 80, G60 zinc coating.
2. Profile Depth: As indicated on Plan.
3. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.
6. Vent Slot Area: Manufacturer's standard vent slots providing 1.5 percent open area.

2.6 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth unless otherwise indicated on Drawings.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A 780.

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
   1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Space and locate welds as indicated on Drawings.
3. Weld Washers: Install weld washers at each weld location where deck is 22 gage or less.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:
1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch only with concrete filled decks.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Revise "Floor-Deck Closures" Paragraph below to suit Project. Sealing cellular deck openings, butt joints, and junctions with trench headers with tape is not included in this Section. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Electrified Cellular Floor Deck: Install cellular floor system with deck assembled from units indicated.
1. Coordinate layout and installation of trench headers, preset inserts, duct fittings, and other components specified in Section 260539 "Underfloor Raceways for Electrical Systems" with installation of electrified cellular metal floor deck.

G. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.4 COMPOSITE FLOOR DECK INSTALLATION

A. The composite steel deck shall be connected to the supporting steel beams by welding the shear/headed stud connectors through the deck as indicated in the drawings. Contractor to verify the attachment of the deck to the supporting member after the headed stud is welded. Improper amperage may cause burn through around the stud and the deck may not be adequately attached to the supporting deck.

B. Where shear/headed stud connectors are not specified, the metal deck shall be attached to the supporting steel with 3/4-inch diameter puddle welds at a maximum spacing of 12 inches.

C. Where the specified shear/headed stud connector spacing exceeds 12 inches, provide 3/4-inch diameter puddle welds between shear/headed stud connectors to maintain a maximum deck connection of 12 inches.

D. Where deck units abut side to side or end to end over a supporting member provide 3/4-inch diameter puddle welds on each deck unit at a maximum spacing of 12 inches.

E. Shear/Headed Stud Connectors: Field weld shear/headed stud connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Located connectors as indicated in the drawings. Remove and discard arc shields after welding shear/headed stud connectors.

3.5 DECK AND FLOOR DEFLECTION

A. The metal deck is designed to deflect up to 3/4-inch.

B. Uncambered steel beams are designed to be within code required deflection limits (Span/240). Cambered steel beams are designed to have a final deflected shape of less than 1/2-inch. Due to field tolerances and camber tolerances, these design limits may be slightly exceeded.

C. The contractor shall account for any additional concrete required due to these deflected shape tolerances.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Refer Section 01 45 23.

B. Remove and replace work that does not comply with specified requirements.

C. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.7 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 31 23 - STEEL ROOF DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Roof deck.
2. Acoustical roof deck.
3. Noncomposite vented roof deck.

B. Related Requirements:
1. Section 01 45 23 “Testing and Inspection Services”
2. Section 05 12 00 "Structural Steel Framing".

1.3 REFERENCES

A. Comply with applicable provisions of the following specifications and documents. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.
1. AWS D1.1 – Structural Welding Code
2. AWS D1.3 – Structural Welding Code – Sheet Steel
3. SDI – Design Manual
4. SSPC – Painting Manual
5. UL – Fire Resistance Directory
6. ICBO – Product Evaluation Reports
7. FM – Roof Assembly Classifications

B. In the case of conflict between the Contract Documents and a referenced standard, the Contract Documents shall govern. In the case of a conflict between the Contract Documents and the Building Code, the more stringent shall govern.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Refer Section 01 45 23.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company.
   2. Canam United States; Canam Group Inc.
   3. CMC Joist & Deck.
   4. Consolidated Systems, Inc.; Metal Dek Group.
   5. Cordeck.
   6. DACS, Inc.

7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
15. CSM Metal Deck

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
a. Color: Manufacturer's standard.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
a. Color: Manufacturer's standard.
4. Deck Profile: As indicated on plan.
5. Profile Depth: As indicated on plan.
6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
7. Span Condition: Triple span or more.
8. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACOUSTICAL ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
a. Color: Manufacturer's standard.
2. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
3. Deck Profile: As indicated in Structural General Notes.
4. Cellular Deck Profile: As indicated in Structural General Notes.
5. Profile Depth: As indicated in Structural General Notes.
6. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.

7. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated in Structural General Notes.
8. Span Condition: Triple span or more.
9. Side Laps: Overlapped or interlocking seam at Contractor's option.
10. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.
11. Sound-Absorbing Insulation: Manufacturer's standard pre-molded roll or strip of glass or mineral fiber.
    a. Factory install sound-absorbing insulation into cells of cellular deck.

2.4 NONCOMPOSITE VENTED ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Marlyn Steel Decks, Inc.
6. New Millennium Building Systems, LLC.
7. Nucor Corp.; Vulcraft Group.
8. Roof Deck, Inc.
9. Verco Manufacturing Co.
10. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Noncomposite Vented Roof Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, G60 zinc coating.
2. Profile Depth: As indicated in Structural General Notes.
3. Design Uncoated-Steel Thickness: As indicated in Structural General Notes.
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.
6. Vent Slot Area: Manufacturer's standard vent slots providing 1-1/2.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth unless otherwise indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A 780.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.
   1. Fasteners shall provide diaphragm shear and uplift resistance equal to or greater than welding indicated herein and on Drawings.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: As indicated on Structural Plans.
   2. Weld Spacing: As indicated on Structural Plans.
   3. Weld Washers: Install weld washers at each weld location if deck gauge is lighter than 22 gauge.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals shown on Structural Plans:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
   2. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: See Section 01 45 23.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 40 00 - COLD FORMED METAL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Load bearing wall framing.
   2. Exterior non-load bearing wall framing.
   3. Floor joist framing.
   4. Roof rafter framing.
   5. Ceiling joist framing.
   6. Soffit framing.
   7. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications.
   2. Section 09 21 16 - Gypsum Board Assemblies.
   3. Section 09 90 00 - Painting and Coating.

1.3 REFERENCE ST

A. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

E. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.

F. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

G. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections; 2018.

H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

I. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

J. ASTM E1190 - 2021 Edition, November 15, 2021 Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members; 2021 Edition, November 15, 2021.

K. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

L. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: General Contractor shall engage a qualified professional engineer, licensed in the State of Texas, to design cold formed steel framing.

B. Structural Performance - Delegated design engineer shall provide cold-formed steel framing designs capable of withstanding all code required design loads within limits and under conditions indicated on the construction documents and within this Specification:

1. Design loads: Designs shall be capable of withstanding the worst case loading as indicated on the structural drawings, and/or as required by the locally adopted Building Code. The design shall cover the worst case loading in all instances.
2. Coordinate the requirements on the structural and architectural Drawings with the requirements of this Section. If a conflict exists, notations on the structural drawings take precedence.
3. The following document governs the Work, except where more restrictive items are specified:
    a. AISI Design of Cold-Formed Steel Structural Members Wind Load:
        1) Minimum design loads for exterior and/or load bearing and/or soffit applications:
            (a) As required by code officials having jurisdiction.
            (b) Deflection: 1/600 for clear simple spans.
            (c) Deflection: 1/300 for cantilever conditions and roof parapets.
            (d) Gauge: 16 gauge minimum, unless noted otherwise.
        2) Minimum design loads for interior and/or exterior suspended furr-downs with a maximum vertical drop on either side of 5 feet or greater:
            (a) As required by Authorities Having Jurisdiction (AHJ).
            (b) Deflection: 1/600 for clear simple spans.
            (c) Deflection: 1/300 for cantilever conditions and roof parapets.
            (d) Gauge: 20 gauge minimum, unless noted otherwise.
4. It is a common practice for studs thinner than 20 gauge to be crimped and/or ribbed to increase the strength of the overall stud cross section for various loading applications. These studs are typically noted by manufacturer as “equivalent” to a thicker gauge. These “equivalent” type studs are not allowed in a vertically suspended application with greater than 5 feet of vertical wall drop, 20 gauge is the minimum thickness allowed for these applications.
5. Welding qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
6. Studs, tracks, channels, and other light gauge framing members shall conform to requirements of ASTM C955.
7. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.
8. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F (87 degrees C).
9. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure:
    a. Upward and downward movement of 1-1/2 inch (38 mm).
10. Design exterior non-load bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold Formed Steel Framing Design Standards:
1. Wall studs: AISI S211.
2. Headers: AISI S212.
3. Lateral design: AISI S213.

1.5 SUBMITTALS

A. Product Data: Technical data for cold formed steel framing product and accessories including factory applied primers.

B. Shop Drawings:

1. Submit layout, spacings, sizes, thickness, and types of cold formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners:
   a. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   b. Shall bear the seal of a Registered Professional Engineer, licensed in the State of Texas.

C. Supplementary Design Details: The general design is presumed adequate to permit compliance with the specified performance. Provide engineering calculations and shop drawings to supplement the general design. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of Texas. Calculations and shop drawings must show design will withstand wind loading commiserate with class and rating of the Project.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Welding qualifications:
      a. Qualify procedures and personnel according to the following:
         1) AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
         2) CCFSS Technical Bulletin: “AISI Specification Provision for Screw Connections.”
   2. Comply with AISI North American Specification for the Design of Cold Formed Steel Structural Members and Standard for Cold Formed Steel Framing - General Provisions:
      a. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
   3. Fire Resistance Ratings: ASTM E119; testing by a UL. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL Fire Resistance Directory.
   4. Installer qualifications: Company specializing in the installation of cold formed metal framing components with minimum five (5) years’ documented experience.
   5. Install system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   6. Install system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   7. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.

B. Professional Engineer Qualifications:
   1. A professional engineer who is legally qualified to practice in the State of Texas and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold formed metal framing that are similar to those indicated in material, design, and extent:
      a. Engineering Responsibility: Preparation of shop drawings, design calculations, and structural data.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years’ experience

manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. CEMCO.
2. ClarkDietrich Building Systems.
3. Consolidated Fabricators Corp.
4. SCAFCO Corporation.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 LOAD BEARING WALL FRAMING

A. Steel Studs:
   1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
      a. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange Width: 1-5/8 inches (41 mm).
      c. Section Properties: As indicated on Drawings.

B. Steel Track:
   1. U-shaped steel track, of web depths indicated, unpunched, with straight flanges:
      a. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange Width: 1-1/4 inches (32 mm).

C. Steel Box or Back to Back Headers:
   1. C-shape used to form header beams, of web depths indicated, unpunched, with stiffened flanges:
      a. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange Width: 1-5/8 inches (41 mm).

D. Steel Single or Double L Headers:
   1. L-shapes used to form header beams, of web depths indicated:
      a. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Top Flange Width: 1-5/8 inches (41 mm).
      c. Section Properties: As indicated on Drawings.

2.3 EXTERIOR NONLOAD BEARING WALL FRAMING

A. Steel Studs:
   1. C-shaped steel studs, of web depths indicated, punched, with stiffened flanges:
      a. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange Width: 1-5/8 inches (41 mm).
      c. Section Properties: As indicated on Drawings.

B. Steel Track:
   1. U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
      a. Minimum Base Metal Thickness: 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
      b. Flange Width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips:
   1. Head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web:
      a. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years'

experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
1) ClarkDietrich Building Systems.
2) SCAFCO Corporation.
3) Simpson Strong-Tie Co., Inc.
4) Steeler, Inc.
5) Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

D. Single Deflection Track:
1. Single, deep leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure:
a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
b. Flange width: One inch (25 mm) plus the design gap for one story structures and one inch (25 mm) plus twice the design gap for other applications.

E. Double Deflection Tracks:
1. Double, deep leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges:
a. Outer track - Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure:
1) Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
2) Flange width: 1 inch (25 mm) plus the design gap for one story structures and 1 inch (25 mm) plus twice the design gap for other applications.
2. Inner track - of web depth indicated:
a. Minimum base metal thickness: 0.0428 inch (1.09 mm), 0.0538 inch (1.37 mm), 0.0677 inch (1.72 mm), and 0.0966 inch (2.45 mm).
b. Flange width: 1 inch (25 mm) plus the design gap for one story structures and 1 inch (25 mm) plus twice the design gap for other applications.

F. Drift Clips: Bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists:
1. C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges:
a. Minimum Base Metal Thickness: 0.0428 inch (1.09 mm).
b. Flange Width: 2 inches (51 mm), minimum.

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame:
1. C-shaped steel sections, of web depths indicated, with stiffened flanges:
a. Minimum Base Metal Thickness: 0.0428 inch (1.09 mm).
b. Flange Width: 1-5/8 inches (41 mm) minimum.

2.6 FRAMING ACCESSORIES

A. Fabricate steel framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of appropriate thickness and configuration, unless otherwise indicated:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.

4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

C. Anchors, Clips, and Fasteners:
1. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot dip process according to ASTM A123/A123M.
2. Expansion anchors: Fabricated from corrosion resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
3. Power actuated anchors: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with allowable load capacities calculated, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
4. Mechanical fasteners:
   a. ASTM C1513 ASTM C1513, corrosion resistant coated, self-drilling, self-tapping, steel drill screws:
      1) Head type: Low profile head beneath sheathing.
5. Welding electrodes: Comply with AWS standards.

D. Miscellaneous Materials:
1. Galvanizing Repair Paint: SSPC-Paint 20 or ASTM C780.
2. Non-Metallic, Non-Shrink Grout: Premixed, non-metallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage compensating agents, and plasticizing and water reducing agents, complying with ASTM C1107/C1107M, with fluid consistency and 30-minute working time.
3. Shims: Load bearing, high density multimonomer plastic, and non-leaching; or of cold formed steel of same grade and coating as framing members supported by shims.
4. Sealer Gaskets: Closed cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer written instructions, and specified requirements:
1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted:
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to shop drawings, with screw penetrating joined members by no fewer than three (3) exposed screw threads.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances:
1. Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in ten (10) feet (1:960) and as follows:

a. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
b. Squareness: Fabricate each cold formed steel framing assembly to a maximum out of square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

3.2 PREPARATION

A. Before sprayed fire resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire resistive materials, remove only as much as necessary to complete installation of cold formed framing without reducing thickness of fire resistive materials below required thickness to obtain fire resistance rating indicated. Protect remaining fire resistive materials from damage.

C. Install load bearing shims or grout between the underside of load bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 ERECTION

A. General:
1. Track Anchors: Install anchors maximum 4 feet on center; design anchors and spacing to carry live, dead, and wind loads.
2. Track Splices: Provide channel inserts or weld track splices.
3. Erection: Install members plumb, level, and in a true plane.
4. Fastenings: Make assembly rigid and secure, with welds free of voids and burnouts.

B. Install metal framing systems in accordance with stud manufacturer's printed instructions.

C. Runner Tracks:
1. Install continuous tracks sized to match studs.
2. Align tracks accurately to layout at base and tops of studs.
3. Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches on center for nail or power-driven fasteners, nor 16 inches on center for other types of attachment.
4. Provide fasteners at corners and ends of tracks.
5. Tracks shall be anchored to structural steel prior to installing sprayed on insulation.
6. Provide deflection track (DT), at top of stud walls at floor or roof above, typically. Allow for 1/2 inch movement of primary structure. Do not attach studs directly to deflection track.
7. Vertical deflection clips: Provide manufacturer’s standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure.

D. Secure studs to top track and bottom runner track by means of approved self-drilling screws or welding at both inside and outside flanges of 14 gauge or heavier material. Screws and welds shall be of sufficient size to insure strength of connection. All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structures."

E. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

F. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure. Use Zee clips as specified above. Weld "Z" shaped clips to structural members as shown on drawings. Maximum 2 feet on center vertical.

G. Install supplementary framing, blocking, and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.

H. Frame wall openings with extra studs, equal to the number of studs interrupted by wall openings, placed at each side of wall openings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.

I. Install bracing/bridging in accordance with manufacturer’s instructions and design conditions.

J. Touch up field welds and damaged galvanized coating, except touch up of field cut studs is not required.

K. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

L. Install horizontal stiffeners in stud system, space (vertical distance) at no more than 54 inches on center. Weld at each intersection.

3.4 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track:
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel stud sections as indicated on shop drawings.

C. Space joists not more than 2 inches (51 mm) from abutting walls:
   1. Joist Spacing: 16 inches (406 mm).

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on shop drawings:
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on shop drawings. Fasten bridging at each joist intersection as follows:
   1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold down angles, anchors, and fasteners, to provide a complete and stable joist framing assembly.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Bollards.
a. Metal Pipe Bollards, _____.
b. Pipe/downspout guards.
2. Steel framing and supports for ceiling-hung toilet partitions.
3. Steel framing and supports for operable partitions.
4. Steel framing and supports for overhead doors and grilles.
5. Steel tube reinforcement for low partitions.
6. Steel framing and supports for mechanical and electrical equipment.
7. Steel framing and supports (outriggers) for window washing equipment.
8. Mounting brackets and anchorages for window washing equipment.
9. Catwalk Structure.
10. CMU Partition Head Supports.
11. Custom-fabricated sheet metal reveals.
12. Equipment framing and supports.
13. Elevator hoistway beams.
14. Support angles for elevator door sills.
15. Elevator pit sump cover.
16. Equipment guards.
17. Folding metal gates.
18. Horizontal sliding grille framing and supports.
19. Ladder safety cages.
20. Loose steel lintels.
21. Loose bearing and leveling plates.
22. Metal ladders.
23. Band Tower.
24. Miscellaneous steel, including steel angle corner guards, steel edgings, and loading dock edge angles
25. Partial-height partition reinforcing steel tube.
26. Shelf angles.
27. Slotted channel framing.
28. Accessories as necessary for complete installation.

1.3 REFERENCE STANDARDS

A. 2012 TAS - Texas Accessibility Standards; 2012.

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2019, with Errata (2021).

D. ASTM A27/A27M - Standard Specification for Steel Castings, Carbon, for General Application; 2020.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).

G. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2016).

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

J. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

K. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.

L. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

M. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

N. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

O. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

P. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

Q. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

R. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

S. ASTM A741 - Standard Specification for Metallic-Coated Steel Wire Rope and Fittings for Highway Guardrail; 2011.

T. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

U. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

V. ASTM A793 - Standard Specification for Rolled Floor Plate, Stainless Steel; 1996.

W. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

X. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

Y. ASTM B36/B36M - Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar; 2018.

Z. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

AA. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

BB. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

CC. ASTM B455/B455M - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes; 2020.

DD. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2022.

EE. ASTM B632/B632M - Standard Specification for Aluminum-Alloy Rolled Tread Plate; 2024.

FF. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

GG. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

HH. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

II. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

JJ. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).

KK. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete Elements; 2022.

LL. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.

MM. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2009 (Reapproved 2020).

NN. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

OO. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric; 2016.

PP. ASTM F2329/2329M - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners; 2015.

QQ. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

RR. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

SS. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

TT. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

UU. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders and countertop supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Ladders: Provide ladders and landings capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Structural Performance:
   1. Countertops and Vanities: Provide countertop and vanity framing capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
      a. All deadloads.
      b. 500 pound live load placed on the countertop and vanity.
      c. Deflection at Midspan: L/1000 times span or 1/8 inch whichever is less.

D. Thermal Movements:
   1. Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other

detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:

a. Temperature change (range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.5 SUBMITTALS

A. Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories.

B. Shop Drawings:
   1. Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items:
      a. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding Certificates.

E. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code - Comply with applicable provisions of the CBC 2019 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA):
      a. CBC Section 11B-504 where applicable (accessibility).
   2. Building Code: Comply with applicable requirements of the IBC for metal fabrications.
   3. Welding - qualify procedures and personnel according to the following:
      a. AWS D1.1/D1.1M Structural Welding Code – Steel.
      b. AWS D1.2/D1.2M Structural Welding Code - Aluminum.
      c. AWS D1.3/D1.3M Structural Welding Code - Sheet Steel.
      d. AWS D1.6/D1.6M Structural Welding Code - Stainless Steel.
      e. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Fabricator/Installer Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this work for a minimum of 5 years, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated in material, design, and extent.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
   1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
   2. Provide allowance for trimming and fitting at site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle to prevent any type of damage to the fabricated work.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General:
   1. Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
   2. Slotted Channel Framing: Cold formed metal box channels (struts) complying with MFMA-4.
      a. Size of Channels: 1-5/8 inches by 1-5/8 inches (41 mm by 41 mm).
      b. Material: Galvanized steel ASTM A653/A653M, commercial steel, Type B. with G90 (Z275) coating; 0.108 inch (2.8 mm) nominal thickness.
      c. Cold Formed Metal Channels: Flange edges returned toward web and with 9/16 inch (14.3 mm) wide slotted holes in webs at 2 inches (51 mm) o.c.
      d. Width of Channels: 1-5/8 inches (41 mm).
      e. Depth of Channels: As indicated on Drawings.
      f. Metal and Thickness: Galvanized steel complying with ASTM A653/A653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108 inch (2.8 mm) nominal thickness.
      g. Finish: Hot dip galvanized after fabrication.
   3. Fasteners: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
      a. Provide stainless steel fasteners for fastening aluminum.
      b. Provide stainless steel fasteners for fastening stainless steel.
      c. Provide stainless steel fasteners for fastening nickel silver.
      d. Provide bronze fasteners for fastening bronze.
      e. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563/A563M; and, where indicated, flat washers.
      f. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A325/A325M, Type 3; with hex nuts, ASTM A563/A563M, Grade C3 (ASTM A563M, Class 8S3); and, where indicated, flat washers.
      g. Stainless Steel Bolts and Nuts: Regular hexagon head annealed stainless steel bolts, ASTM F1554 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy.
      h. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563/A563M; and, where indicated, flat washers.
         1) Hot dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

i. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M , conducted by a qualified independent testing agency.
j. Cast in Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F2329/2329M.
k. Post Installed Anchors:
    1) Material for Interior Locations: Carbon steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
    2) Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) or Group 2 (A4) stainless steel bolts, ASTM F593 ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).
l. Slotted Channel Inserts: Cold-formed, hot-dip galvanized steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee head bolts, complete with washers and nuts, all zinc plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts

B. Aluminum:
1. Aluminum Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.
2. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
3. Aluminum Alloy Rolled Tread Plate: ASTM B632/B632M , Alloy 6061-T6.
4. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

C. Bronze:
1. Bronze Extrusions: ASTM B455/B455M, Alloy UNS No. C38500 (extruded architectural bronze).
2. Bronze Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
3. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

D. Cast Iron:
1. Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

E. Nickel:
1. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
2. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

F. Stainless Steel:
1. Stainless Steel Sheet, Strip, and Plate:ASTM A240/A240M or ASTM A666, Type 304.
2. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
3. Rolled Stainless Steel Floor Plate: ASTM A793.

G. Steel:
1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
2. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
3. Steel Tubing: ASTM A500/A500M, cold formed steel tubing.
4. Rolled Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

H. Zinc Coated Steel Wire Rope: ASTM A741:

1. Wire Rope Fittings: Hot dip galvanized steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

I. Abrasive Surface Floor Plate:
   1. Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel:
      a. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
         1) IKG Industries, a division of Harsco Corporation.
         2) SlipNOT Metal Safety Flooring; W.S. Molnar Company.

J. Fasteners:
   1. Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required:
      a. Provide stainless steel fasteners for fastening aluminum.
      b. Provide stainless steel fasteners for fastening stainless steel.
      c. Provide stainless steel fasteners for fastening nickel silver.
      d. Provide bronze fasteners for fastening bronze.
      e. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A307, Grade A with hex nuts, ASTM A563/A563M and, where indicated, flat washers.
      f. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM F3125/F3125M, Type 3 with hex nuts, ASTM A563/A563M, Grade C3 and, where indicated, flat washers.
      g. Stainless Steel Bolts and Nuts: Regular hexagon head annealed stainless steel bolts, ASTM F593 with hex nuts, ASTM F594 and, where indicated, flat washers; alloy.
      h. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563/A563M and, where indicated, flat washers:
         1) Hot dip galvanize or provide mechanically deposited zinc coating where item being fastened is indicated to be galvanized.
      i. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
      j. Post Installed Anchors:Torque controlled expansion anchors or chemical anchors
         1) Material for interior locations: Carbon steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
         2) Material for exterior locations and where stainless steel is indicated: Alloy; Group 1 (A1) or Group 2 (A4), ASTM F593, and nuts, ASTM F594.
      k. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F2329/2329M.
      l. Slotted Channel Inserts: Cold-formed, hot-dip galvanized steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee head bolts, complete with washers and nuts, all zinc plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts

K. Miscellaneous Materials:

1. Shop Primer for Ferrous Metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Provide 10-99 (red) or 10-09 (gray) by Tnemec Company.
2. Universal Shop Primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
3. Water Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel and compatible with topcoat.
4. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
5. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Provide Tneme-Zinc 90-97 by Tnemec Company.
6. Bituminous Paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D1187/D1187M.
7. Non-shrink, Non-Metallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
8. Concrete Materials and Properties: Composed of ASTM C150/C150M Type I Portland cement, ASTM C33/C33M sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8 inch with at least 95 percent passing a 3/8-inch sieve and not more than 10 percent passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28-day compressive strength of 3,000 psi (20 MPa).

2.2 FABRICATION

A. Shop Assembly:
   1. Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation:
      a. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
      b. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
      c. Form exposed work with accurate angles and surfaces and straight edges.
      d. Weld corners and seams continuously to comply with the following:
         1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
         2) Obtain fusion without undercut or overlap.
         3) Remove welding flux immediately.
         4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
      e. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
      f. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
      g. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

h. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
i. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with a minimum 6 inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.
j. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.

2. Miscellaneous Framing and Supports: Provide steel framing and supports necessary to complete the work and which are not a part of the structural framework, including but not limited to framing and supports for elevator hoistway beams, elevator sills, overhead lobby door frames, sliding doors, countertop and vanities, ceiling hung toilet compartments, and tube framing for partial height walls, CMU partition head supports, mechanical and electrical equipment.
   a. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.
      1) Fabricate units from slotted channel framing where indicated.
      2) Furnish inserts for units installed after concrete is placed.
   b. Operable Partition Supports: Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
   c. Framing for Ceiling Hung Toilet Compartments: Provide framing for ceiling hung toilet compartments, coordinated with the partitions and including provisions for partition anchorage as required to sustain imposed loads and to limit deflections to L/360 between hangers, fabricated from the following:
      1) Structural Steel Shapes, Plates and Bars: ASTM A36/A36M.
      2) Modular Structural Framing System: ASTM A569; modular, structural quality steel preformed U-channel framing system with continuous open slot prepared to receive attachment nuts, bolts, straps, threaded rods, beam clamps, hanger rods support brackets and other accessories. Provide corrosion resistant finish.
      3) Provide steel rods, 1/2 inch (13 mm) diameter, spaced at maximum 36 inches (900 mm) o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge shape washers for full bearing on sloping flanges of support beam.
      4) Coordinate installation with toilet compartment manufacturer's written instructions and recommendations.
   d. Countertop and Vanity Framing: Custom fabricate countertop and vanity framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thicknesses, sizes and shapes shown, and as required to produce work of adequate strength and durability, without objectionable deflections. Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work.
   e. CMU Partition Head Supports: Fabricate supports from 4 inch x 4 inch x 1/4 inch by 36 inch (100 mm by 100 mm by 6 mm by 900 mm) long structural steel angles. Drill supports a maximum of 12 inches (300 mm) o.c. to receive expansion bolts.
   f. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.

2.3 BOLLARDS

A. Pipe Bollards:

1. Fabricate metal bollards from Schedule 40 steel pipe or 1/4 inch (6.4 mm) wall thickness rectangular steel tubing.
2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
4. Where bollards are to be installed on structural slab or existing paving:
   a. Fabricate bollards with 3/8 inch (9.5 mm) thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4 inch (19 mm) anchor bolts.
   b. Where bollards are anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
5. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4 inch (6.4 mm) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

2.4 CATWALK STRUCTURES

A. General:
   1. Coordinate catwalk requirements with Architectural, Structural, and Theater Drawings and Specifications.
   2. Fabricate from steel shapes as indicated on Drawings.
   3. Provide attachments and all catwalk accessories and miscellaneous supports as indicated.
   4. Weld all joints and grind smooth.
   5. Provide catwalk accessories and miscellaneous supports as indicated.

B. Framing: Refer to Structural.

C. Platforms:
   1. Refer to Section 05 53 00 - Metal Gratings for platform and stair grating requirements.
   2. Ends of grating shall be banded at supports.
   3. Weld grating to supports at bearing bars and banded ends. Align all bars in adjacent panels.

D. Railings:
   1. Refer to Section 05 52 00 - Metal Railings for railing requirements.

E. Finish:
   1. Shop prime paint and field paint under Section 09 90 00 - Painting and Coating.

2.5 ELEVATOR PIT SUMP COVERS

A. Fabricate from 3/16 inch (4.8 mm) steel plate with four 1 inch (25 mm) diameter holes for water drainage and for lifting.
   1. Fabricate from welded or pressure locked steel bar grating Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
   2. Provide steel angle supports as indicated.

2.6 FOLDING METAL GATES

A. Description: Steel scissor-type gate.
   1. Type: Scissor-Type single, pair, and door gate.
   2. Finish: Galvanized Steel.
   3. Webbing: Heavy-duty, 14 gauge, U-channel riveted back-to-back with zinc-plated rivets.
   4. Frame: Heavy-Duty, 12 Gauge, 1-1/2 inch x 1-1/2 inch Vertical Angle Frame.
   5. Casters: Solid Steel.
   6. Locking:
      a. Single Gate shall include heavy-duty 12 gauge zinc-plated angle locking bar with 3/16 inch padlock hasp. Lock shall be on right unless noted otherwise.
      b. Paired Gate shall meet in middle and lock with 3/16 inch padlock hasp.

c. Door Gate shall include heavy-duty 12 gauge zinc-plated angle locking bar with 3/16 inch padlock hasp which shall lock to right wall unless noted otherwise.

7. Mounting: Can be mounted to wall, door frame, or attached to free standing.
8. Size:
   a. Height: 8 feet, unless noted otherwise.
   b. Width: As required.
9. Basis of Design: “Heavy-Duty Folding Gates” manufactured by Illinois Engineered Products.

2.7 GUARDS

A. Equipment Guards
   1. Provide metal tube framing for security and public safety around equipment where indicated on Drawings.
   2. Fabricate equipment guards from 1-1/2 inch O.D. steel tube.
   3. Finish Paint Federal Yellow or add stripe caution reflective tape.

B. Pipe and Downspout Guards
   1. Fabricate pipe and downspout guards from 3/8 inch (9.5 mm) thick by 12 inch (300 mm) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with two-inch (50 mm) clearance between pipe and pipe guard. Drill each end for two (2) 3/4-inch (19 mm) anchor bolts.
   2. Galvanize and prime pipe, downspout guards.

2.8 LADDERS

A. Comply with ANSI A14.3. For elevator pit ladders, comply with ASME A17.1/CSA B44

B. Aluminum Ladders:
   1. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   2. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
   3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
   4. Rungs: Extruded aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.
   5. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
   6. Provide platforms as indicated fabricated from pressure locked aluminum bar grating, supported by extruded aluminum framing. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
   7. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted aluminum brackets.
   8. Provide minimum 72 inch (1830 mm) high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.9 LADDER SAFETY CAGES

A. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless steel fasteners.
   1. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet (6 m) o.c. Provide secondary intermediate hoops spaced not more than 48 inches (1200 mm) o.c. between primary hoops.
   2. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless steel fasteners unless otherwise indicated.

B. Aluminum Ladder Safety Cages:
   1. Primary Hoops: 1/4 inch by 4 inch (6.4 mm by 100 mm) flat bar hoops.

2. Secondary Intermediate Hoops: 1/4 inch by 2 inch (6.4 mm by 50 mm) flat bar hoops.
3. Vertical Bars: 1/4 inch by 2 inch (6.4 mm by 50 mm) flat bars secured to each hoop.

2.10 BAND TOWER

A. Basis of Design: KC Metal Works or approved equal.
   1. Engineered stamped drawing for the permitting, construction and installation of the tower installation on grade.
   2. Install new foundation and tower - refer to structural drawings for foundation.
   3. One 10 foot by 5 foot platform elevated at 10 feet above finished ground floor surface.
   4. Spiral Staircase should only be installed to elevated platform.
   5. Each platform to be surrounded by 4 foot tall 3-rail railing.
   6. Provide galvanized metal fully covered sunscreen top 10 feet above the elevated platform.
   7. Engineered welded steel construction.
   8. Tower to include a 24 inch wide spiral staircase that is 24 feet tall to reach first and top platforms.
   9. Safety chains are to be placed at each level crossing openings to stairs.
   10. 6 foot cage to be installed around the base of the stiars with a lockable door.
   11. To built per OSHA standards.
   12. Finish : Galvanized.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide steel framing and supports necessary to complete the work and which are not a part of the structural framework, including but not limited to the following:
   1. Ceiling-hung toilet compartments.
   2. CMU partition head.
   3. Coiling overhead door.
   4. Coiling overhead grille.
   5. Countertop and vanities.
   6. Elevator hoistway beams
   7. Elevator door sills.
   8. Equipment.
   9. Horizontal sliding grilles.
   10. Loose bearing and leveling plates
   11. Loose steel lintels.
   12. Operable partition supports.
   13. Partial-height partition reinforcing tube steel.
   14. Shelf angles.

B. Fabrication, General:
   1. Fabricate from steel shapes, plates, and bars of welded construction unless otherwise indicated.
   2. Fabricate to sizes, shapes, and profiles indicated on Drawings and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items:
   3. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   4. Fabricate units from slotted channel framing where indicated.
   5. Provide inserts for units installed after concrete is placed.

C. Ceiling-Hung Toilet Partition Supports:
   1. Framing for Ceiling Hung Toilet Compartments: Provide framing for ceiling hung toilet compartments, coordinated with the partitions and including provisions for partition anchorage as required to sustain imposed loads and to limit deflections to L/360 between hangers, fabricated from the following.
      a. Structural Steel Shapes, Plates and Bars: ASTM A36/A36M.

b. Modular Structural Framing System: ASTM A1011/A1011M; modular, structural quality steel preformed U-channel framing system with continuous open slot prepared to receive attachment nuts, bolts, straps, threaded rods, beam clamps, hanger rods support brackets and other accessories. Provide corrosion resistant finish.
c. Provide steel rods, 1/2 inch (13 mm) diameter, spaced at maximum 36 inches (900 mm) o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge shape washers for full bearing on sloping flanges of support beam.
d. Coordinate installation with toilet compartment manufacturer's written instructions and recommendations.

D. CMU Partition Head Supports:
1. Fabricate supports from 4 inch x 4 inch x 1/4 inch by 36 inch (100 mm by 100 mm by 6 mm by 900 mm) long structural steel angles. Drill supports a maximum of 12 inches (300 mm) o.c. to receive expansion bolts.

E. Loose Bearing and Leveling Plates:
1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction.
a. Drill plates to receive anchor bolts and for grouting.
b. Galvanize plates

F. Operable Partition Supports:
1. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

G. Shelf Angles:
1. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4 inch (19 mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
a. Provide mitered and welded units at corners.
b. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
c. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
d. Galvanize and prime shelf angles located in exterior walls.
e. Prime shelf angles located in exterior walls with zinc rich primer.
f. Furnish wedge type concrete inserts, complete with fasteners, to attach shelf angles to cast in place concrete.

2.12 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation from Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

2.13 FINISHES

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
   1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

2.15 STAINLESS STEEL FINISHES

A. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Bright, Directional Polish: No. 4 finish.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.16 STEEL AND IRON FINISHES

A. Galvanizing:
   1. Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products:
      a. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming:
   1. Prepare surfaces to comply with requirements indicated below:
      a. Exterior items: SSPC SP6/NACE No. 3, "Commercial Blast Cleaning."
      b. Items indicated to receive zinc-rich primer: SSPC SP6/NACE No. 3, "Commercial Blast Cleaning."
      c. Items indicated to receive primers specified in Section 09 96 00 - High-Performance Coatings: SSPC SP6/NACE No. 3, "Commercial Blast Cleaning."
      d. Other items: SSPC SP3, "Power Tool Cleaning."

E. Shop Priming:
   1. Apply shop primer to comply with SSPC PA1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting:
      a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

3.2 FIELD CONDITIONS

A. Field Measurements:
   1. Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication:

a. Established dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
b. Provide allowance for trimming and fitting at site.

3.3 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation, with edges and surfaces level, plumb, true, and free of rack, and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding:
1. Comply with the following requirements:
a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
b. Obtain fusion without undercut or overlap.
c. Remove welding flux immediately.
d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection:
1. Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
a. Cast aluminum: Heavy coat of bituminous paint.
b. Extruded aluminum: Two (2) coats of clear lacquer.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 INSTALLING BOLLARDS

A. Fill metal capped bollards solidly with concrete and allow concrete to cure seven days before installing.
1. Do not fill removable bollards with concrete.

B. Install plumb.

C. Backfill as indicated on Drawings.

3.6 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on shop drawings.

B. Anchor supports for ceiling-hung toilet partitions, operable partitions, overhead coiling doors, and overhead coiling grilles securely to, and rigidly braced from, building structure.
   1. Ceiling Hung Toilet Partitions: Anchor supports securely to, and rigidly brace from, overhead building structure.
   2. CMU Partition Head Supports: Unless otherwise indicated place partition head supports on alternate faces of CMU partitions every 6 feet o.c. and expansion bolt to underside of structure. Do not bolt to CMU partitions.

3.7 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch (6mm).

C. Maximum Out of Position: 1/4 inch (6mm).

3.8 ADJUSTING AND CLEANING

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC PA1 for touching up shop painted surfaces:
      a. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.
   2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 - Painting and Coating.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 05 51 50: LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum access ladders.

B. Aluminum ship's ladders.

C. Aluminum cage ladders.

1.2 RELATED SECTIONS

A. Section 05500 – Metal Fabrications: Fasteners and installation requirements used to attach ladders to structure.

1.3 REFERENCES

A. AA – Aluminum Association.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. OSHA 1910.27 – Fixed Ladders.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product.

C. Shop Drawings:

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.

2. Provide templates for anchors and bolts specified for installation under other Sections.

3. Provide reaction loads for each hanger and bracket.

D. Qualification Data:

1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.

F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

1. Record of successful in-service performance.
2. Sufficient production capacity to produce required units.
3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Install ladder in area designated by Architect.
2. Do not proceed with remaining work until workmanship and installation are approved by Architect.
3. Rework mock-up as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.8 WARRANTY

A. A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of **5 years** commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.

2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.

3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.9 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: **O'Keeffe's, Inc.**; 100 N Hill Drive, Suite 12, Brisbane, CA 94005. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web: http://www.okeeffes.com.

B. Substitutions: Before proposal date upon roof consultant approval.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.

2.2 APPLICATIONS/SCOPE

A. Fixed and Cage Ladder Design:

1. Safety cages are required on ladders over 20 feet (6096 mm)

2. Safety cages are required on all ladders in high or hazardous areas.

3. Landing platforms are required at 30 feet (9144 mm) above the bottom of the ladder.

4. Rail and harness fall arrest system as alternate to safety cage and landing platforms shall be a permissible manufacturer's option.

    a. Fixed Ladder Bottom Bracket:

    b. Bottom floor supported bracket.

    c. Bottom wall supported bracket.

    d. Bracket as drawn.

B. Fixed Access Ladder:

1. Standard Duty Channel Rail.
    a. Model 500 as manufactured by O'Keeffe's Inc.
2. Heavy Duty Tubular Rail.
    a. Model 501 as manufactured by O'Keeffe's Inc.
3. Tubular Rail Low Parapet Access Ladder with Roofover Rail Extension.
    a. Model 502 as manufactured by O'Keeffe's Inc.
4. Tubular Rail Low Parapet Access Ladder with Platform and Return.
    a. Model 503 as manufactured by O'Keeffe's Inc.
5. Tubular Rail Low Parapet Access Ladder with Platform.
    a. Model 503A as manufactured by O'Keeffe's Inc.
6. Tubular Rail Low Parapet Access Ladder with Walk-through Rail Extension.
    a. Model 504 as manufactured by O'Keeffe's Inc.

C. Cage Ladder:

1. Cage Ladder with Roof Hatch Rail Extension.
    a. Model 531 as manufactured by O'Keeffe's Inc.
2. Cage Ladder with Roofover Rail Extension.
    a. Model 532 as manufactured by O'Keeffe's Inc.
3. Cage Ladder with High Parapet Access, Platform and Return.
    a. Model 533 as manufactured by O'Keeffe's Inc.
4. Cage Ladder with High Parapet Access, Platform and No Return.
    a. Model 533A as manufactured by O'Keeffe's Inc.
5. Tubular Rail Low Parapet Cage Ladder with Walk-through Extension.
    a. Model 534 as manufactured by O'Keeffe's Inc.

D. Ship Ladder:

1. Ships Ladder.
    a. Model 520 as manufactured by O'Keeffe's Inc.
2. Ship Ladder with Platform.
    a. Model 521 as manufactured by O'Keeffe's Inc.

3. Ship Ladder with Platform and Return.
    a. Model 522 as manufactured by O'Keeffe's Inc.
4. Ship Ladder with Access to Roof Hatch.
    a. Model 523 as manufactured by O'Keeffe's Inc.
5. Incline:
    a. 60 degree.
    b. 75 degree.
    c. As drawn.

2.3 FINISHES

A. Mill finish. As extruded.

B. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

C. Paint. Urethane over chemically pretreated substrate.
    1. Fire Red (RAL 2002).
    2. Alert Orange (RAL 2003).
    3. Warning Blue (RAL 5005).
    4. Caution Yellow (RAL 1018).
    5. Safety Green (RAL 6001).
    6. As scheduled on drawings.

2.4 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.5 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
    1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-

locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Ship Ladders: Not less than 1-1/4 inches (32mm) high, 4-1/8 inch (105 mm) deep and 2 feet (610 mm) wide; tread spacing shall be 1 foot (305 mm) on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches (38 mm) in diameter with hemispheric end caps.

E. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

F. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.

G. Security Doors: Formed 1/8 inch (3 mm) thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches (51 mm) of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.

H. Ship Ladder Seismic Bottom Support: Manufacturer's standard; two isolation bearings per stringer.

I. Ladder Safety Post: Retractable hand hold and tie off.

J. Rail and Harness Fall Arrest System: Supplied where specified as alternate to safety cage and landing platforms, in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components.

K. Safety Cages:

1. Fabricate ladder safety cages to comply with authority having jurisdiction. Assemble by welding. Spacing of primary hoops, secondary hoops and vertical bars shall not exceed that required by code.

2. Safety cage hoops and vertical bars: 3/16 inch (5 mm) by 2 inches (51 mm) aluminum bar.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 05 51 50

SECTION 05 73 00 - DECORATIVE RAILING SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Pre-engineered, component-based, ornamental stainless steel railing system.

1.3 REFERENCES

A. National Ornamental & Miscellaneous Metals Association (NOMMA)
   1. Guideline 1 – Joint Finishes.

1.4 DESIGN REQUIREMENTS

A. Railing system shall be designed to conform to building code and ADA requirements for openings and stress.

B. Railing system shall withstand the minimum concentrated loads in accordance with ASTM E935:
   1. Vertical and Horizontal Force: 200 pounds concentrated load at any point without damage or permanent set.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, and finishes, including maintenance and cleaning instructions.

B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories, and installation. Show details of attaching railing system to supports.

C. Samples: Submit manufacturer's samples of metal finishes for Architect’s approval.

D. Installation instructions include all structural computations and test reports provided by the manufacturer evidencing compliance with the specifications.

E. Manufacturer's Quality Assurance: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

F. Test Reports: Submit test reports from qualified independent testing agency indicating compliance with ASTM E 985.

G. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.

H. Warranty: Submit manufacturer's standard warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

1. Architectural Metal Crafts; (281) 449-1881;
2. Big D Metalworks; (800) 299-9767;
3. Livers Bronze Co.; (816) 300-2828
4. York Metal Fabricators, Inc.; 528-7495.
5. VIVA Railings, LLC.

B. Specifications are based on "CIRCA Perforated Metal Railing System" as manufactured by Viva Railings, Inc.; 972-353-4164.

2.2 DECORATIVE RAILING SYSTEM

A. Pre-Engineered, Component-Based, Ornamental Railing System: Perforated Metal Infill
   1. Guardrail Posts with fascia (side-mounted) rail.
      a. Material: 2-inch OD stainless steel tube, Type 304.
      b. Height: 42 inches.
      c. Spacing: 5'-0" on center maximum.
   2. Handrails: 1-1/2-inch OD stainless steel tube, Type 304.
   3. Finish: Stainless Steel Handrails and Posts: Circular #4 satin.
   4. Perforated Metal:
      a. Type: Stainless steel, Satin #6.
      b. Thickness: 1/8 inch.
      c. Style: Viva Railings' PMSL-0325 or comparable product approved by Architect.
         1) Pickets: 1/2 in. diameter.
         2) Dimensions: 2 feet-6 inches by 2 feet-6 inches, aluminum, powder coat finish as selected by Architect from available manufacturer's available list of colors.
   5. Miscellaneous accessories: Provide necessary fasteners, grout filler, splice connectors, setting blocks and shims, gaskets, sealants, and other accessories as instructed by manufacturer for complete installation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive railing system. Verify that field conditions are acceptable and are ready to receive work.

B. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION

A. Install railing system in accordance with manufacturer's instructions.

B. Install railing system plumb, level, square, true to line, and rigid.

C. Attach railing system securely in place using fasteners supplied or approved by manufacturer. Do not place aluminum in direct contact with concrete or dissimilar metals, provide primer or bituminous paint as instructed by manufacturer.

D. Attach railing system to supports supplied or approved by manufacturer. Mount panels in longest practical lengths to meet performance criteria, and as indicated in approved shop drawings so that spaces between panels are laid out uniformly and symmetrically across balcony or space. Place panels 1/2 inch apart. Do not provide silicone sealant between panels.

E. Field weld handrail and cap components as approved by manufacturer. Welding shall be in accordance with NOMMA Guidelines Finish No. 1.

F. Use manufacturers supplied hardware.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

H. Remove and replace defective or damaged components that cannot be successfully repaired as determined by Architect.

3.3 CLEANING

A. Clean railing system promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

C. Do not use abrasive cleaners.

3.4 PROTECTION

A. Protect installed railing system and finish from damage during other construction.

END OF SECTION 05 73 00

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SECTION 05 75 00 - DECORATIVE FORMED METAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Edge-protection and transition profiles for floors.
   2. Finishing and edge-protection profiles for walls and countertops.

B. Related Sections:
   1. Section 09 21 16 - Gypsum Board Assemblies.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Warranty.

C. Verification Samples: For each finish product specified, minimum size 6 inches (305 mm) square, representing actual product in color and texture.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Package for protection against transportation damage.
   2. Provide markings to identify components consistently with drawings.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation.
   3. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.6 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures for additional warranty requirements.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. C.R. Laurence Co., Inc.: www.crlaurence.com/#sle.
   2. Fry Reglet Corporation: www.fryreglet.com/#sle.
   3. Genesis APS International: www.genesis-gs.com/#sle.
   4. Schluter Systems: www.schluter.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 EDGE-PROTECTION AND TRANSITION PROFILES FOR FLOORS

A. Flooring Transition, Type 1 (MT-1)
   1. Basis of Design Product: Schluter®-RENO-RAMP
   2. Description: anodized aluminum profile with textured, sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Material and Finish: AE - Satin Anodized Aluminum.
   4. Height: Height as required
   5. Ramp Length: As required to maintain a slope not greater than on unit vertically in two units horizontally

B. Flooring Transition, Type 2 (MT-2)
   1. Basis of Design Product: Schluter®-VINPRO-U.
   2. Description: Designed to provide a smooth transition between resilient floor coverings and floor coverings at lower elevations. The sloped surface has been designed to eliminate trip hazards while still providing a discreet and minimal reveal.
   3. Material and Finish: -ATGB, Brushed Nickel Anodized Aluminum.
   4. Width: 17/32 inch.

C. Flooring Transition, Type 3 (MT-3)
   1. Basis of Design Product: Schluter®-RENO-TK
   2. Description: profile with sloped exposed surface, 1/4" (6 mm) deep channel below exposed surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Anchoring Leg: Provide with straight or special radius anchoring leg, as required.
   4. Material and Finish: AT – Satin Nickel Anodized Aluminum.
   5. Height: Height as required

D. Flooring Transition, Type 4 (MT-4)
   1. Basis of Design Product: Schluter®-RENO-U
   2. Description: profile with sloped exposed surface, 5/32" (4 mm) tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Material and Finish: AT – Satin Nickel Anodized Aluminum.
   4. Height: Height as required

E. Flooring Transition, Type 5 (MT-5).
   1. Basis of Design Product: Schluter®-DILEX-AHK
   2. Description: Cove-shaped profile with single anchoring leg for anchoring into floor mortar.
   3. Material and Finish: AT – Satin Nickel Anodized Aluminum.
   4. Height: Height as required
   5. Radius: 3/8 inch (10 mm)

F. Flooring Transition, Type 6 (MT-6)
   1. Basis of Design Product: Schluter®- DILEX-AHKA
   2. Description: Cove-shaped profile for transitions between walls to be tiled and previously finished floors.
   3. Material and Finish: AT – Satin Nickel Anodized Aluminum.
   4. Height: Height as required
   5. Ramp Length: As required to maintain a slope not greater than on unit vertically in two units horizontally.

G. Wall Transition, Type 7, (MT-7)
   1. Basis of Design: Schl Schluter®- DECO-SG.
   2. Description: Decorative profile featuring a 1/2 inch (12.5 mm) – wide channel that creates an attractive shadow gap between tile courses.
   3. Material and Finish: AE – Satin Anodized Aluminum.
   4. Height: As required.

2.3 FINISHING AND EDGE-PROTECTION PROFILES FOR WALLS AND COUNTERTOPS

A. Decorative Trim, Type 1 (DT-1)
   1. Basis of Design Product: Schluter®-JOLLY
   2. Description: L-shaped profile with 1/8" (3.2 mm) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Anchoring Leg: Provide with straight or special radius anchoring leg as required.
   4. Material and Finish: AT - Satin Nickel Anodized Aluminum.
   5. Height: Height as required

2.4 MATERIALS

PART 3 EXECUTION

3.1 APPLICATION

A. Consult manufacturer’s current technical literature for proper design and installation instructions.

END OF SECTION 05 75 00

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SECTION 05 77 00 - DECORATIVE EXTRUDED METAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Edge-protection and transition profiles for floors.
   2. Finishing and edge-protection profiles for walls and countertops.

B. Related Sections:
   1. Section 09 21 16 - Gypsum Board Assemblies.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Warranty.

C. Verification Samples: For each finish product specified, minimum size 6 inches (305 mm) square, representing actual product in color and texture.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Package for protection against transportation damage.
   2. Provide markings to identify components consistently with drawings.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well-ventilated space out of direct sunlight.
   2. Protect from moisture and condensation.
   3. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.6 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures for additional warranty requirements.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. C.R. Laurence Co., Inc.: www.crlaurence.com/#sle.
   2. Fry Reglet Corporation: www.fryreglet.com/#sle.
   3. Genesis APS International: www.genesis-gs.com/#sle.
   4. Schluter Systems: www.schluter.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 EDGE-PROTECTION AND TRANSITION PROFILES FOR FLOORS

A. Flooring Transition, Type 1 (MT-1)
   1. Basis of Design Product: Schluter®-RENO-RAMP
   2. Description: anodized aluminum profile with textured, sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Material and Finish: AE - Satin Anodized Aluminum.
   4. Height: Height as required
   5. Ramp Length: As required to maintain a slope not greater than on unit vertically in two units horizontally

B. Flooring Transition, Type 2 (MT-2)
   1. Basis of Design Product: Schluter®-RENO-T
   2. Description: T-shaped profile with 1/16 inch (1 mm) thick beveled exposed surface and 11/32 inch (9 mm) tall integrated vertical anchoring leg.
   3. Material and Finish: AE - Satin Anodized Aluminum.
   4. Width: 17/32 inch.

C. Flooring Transition, Type 3 (MT-3)
   1. Basis of Design Product: Schluter®-RENO-TK
   2. Description: profile with sloped exposed surface, 1/4" (6 mm) deep channel below exposed surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Anchoring Leg: Provide with straight or special radius anchoring leg, as required.
   4. Material and Finish:AE - Satin Anodized Aluminum.
   5. Height: Height as required

D. Flooring Transition, Type 4 (MT-4)
   1. Basis of Design Product: Schluter®-RENO-U
   2. Description: profile with sloped exposed surface, 5/32" (4 mm) tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Material and Finish: AE - Satin Anodized Aluminum.
   4. Height: Height as required

E. Flooring Transition, Type 6 (MT-6)
   1. Basis of Design Product: Schluter®-DILEX-AHK
   2. Description: Cove-shaped profile with single anchoring leg for anchoring into floor mortar.
   3. Material and Finish: AT – Satin Nickel Anodized Aluminum.
   4. Height: Height as required
   5. Radius: 3/8 inch (10 mm)

F. Flooring Transition, Type 7 (MT-7)
   1. Basis of Design Product: Schluter®- DILEX-AHKA
   2. Description: Cove-shaped profile for transitions between walls to be tiled and previously finished floors.
   3. Material and Finish: AT – Satin Nickel Anodized Aluminum.
   4. Height: Height as required
   5. Ramp Length: As required to maintain a slope not greater than on unit vertically in two units horizontally.

2.3 FINISHING AND EDGE-PROTECTION PROFILES FOR WALLS AND COUNTERTOPS

A. Decorative Trim, Type 1 (DT-1)
   1. Basis of Design Product: Schluter®-JOLLY
   2. Description: L-shaped profile with 1/8" (3.2 mm) wide top section and vertical wall section that together form the visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   3. Anchoring Leg: Provide with straight or special radius anchoring leg as required.

4. Material and Finish: AT - Satin Nickel Anodized Aluminum.
5. Height: Height as required

2.4 MATERIALS

PART 3 EXECUTION

3.1 APPLICATION

A. Consult manufacturer’s current technical literature for proper design and installation instructions.

END OF SECTION 05 77 00

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes rough carpentry, light hardware, and miscellaneous items of work not included in another Section. This Section also includes:
   1. Structural wood supports, grounds, backing, and blocking required for millwork and casework items that are an integral part of wall, floor, and/or ceiling construction.
   2. Plywood sheathing.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 30 00 - Cast-In-Place Concrete.
   3. Section 07 21 00 - Thermal Insulation.
   4. Section 07 92 00 - Joint Sealants.
   5. Section 09 21 16 - Gypsum Board Assemblies.
   6. Section 09 24 00 - Cement Plastering.
   7. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.3 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

B. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2018.

1.4 QUALITY ASSURANCE

A. Lumber and plywood shall be grade or quality marked by WWPA, WCLIB, APA, AWPB, or by other grading and inspection agencies acceptable to Architect. Grade marks shall include the designation "S-DRY"(or "MC-15" as applies) where applicable. Grade and quality marks shall not be apparent on surfaces exposed in the finished work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store kiln dried materials in enclosed areas, protected from moisture and separated from contact with concrete or soil.

PART 2 PRODUCTS

2.1 MATERIALS

A. Temporary Construction: Clean lumber at Contractor's option, rough or smooth, as usage requires.

B. Lumber Not Otherwise Specified or Noted:
   1. Douglas fir or larch, graded and grademarked, according to Reference Standard 1.02 A or B, #1 grade:
      a. Boards: Construction grade.

C. Plywood for Walls and Roofs; as Indicated on Drawings:
   1. Unless glue type is otherwise specified, exterior plywood, interior plywood exposed to continuing moisture, and pressure treated plywood shall be fabricated with exterior glue. Plywood with interior glue shall be fully protected from soaking or continuing moisture at all times.

D. Rough Hardware:

1. Nails, spikes, bolts, screws, tacks, and framing connectors of standard manufacture as required. Hot dip galvanize items exposed to moisture or to exterior and those items that are in contact with wood pressure treated with waterborne salts:
   a. Bolts and Nuts: ASTM A307, Grade A.
   b. Lag Bolts: Fed. Spec. FF-B-561. Pre-drill per CBC.
   c. Nails: Fed. Spec. FF-N-101, common unless otherwise noted or specified.
   d. Joist Hangers and Framing Connectors: Simpson or approved equal, unless otherwise noted.
   e. Power Driven Fasteners: Hilti, Ramset, or approved equal, each use and fastener type subject to prior approval of Architect.

E. Pressure Treatment (Decay and Termite Prevention):
1. Pressure treat for decay and termite prevention, Douglas fir or larch wood materials that are embedded in or set against concrete.
2. Treat in accordance with Reference Standard 1.02 E and quality mark as per Reference Standard 1.02 F.
3. Treat with any of the following processes at Contractor option. Creosote type preservatives are not permitted:
   a. Penta in an LPG carrier (Cellon) or Penta in Hydrocarbon Solvent-Type D (Dow Process) AWPB LP-4 quality marked.
   b. Ammoniacal copper arsenate (ACA) or chromated copper arsenate (CCA) in a water carrier (AWPB LP-2 quality marked).
   c. Disodium Octaborate Tetrahydrate (DOT) such as Advance Guard/Hi-bor by Osmose, Inc.
   d. Members treated with waterborne salts shall be dried to a moisture content not exceeding 19 percent after treatment.
4. Where possible, precut material before treatment.
5. Holes and cutoffs and handling and storage shall be in accordance with AWPA M-4.
6. Ensure that ferrous metal fastenings and items in contact with wood treated with waterborne salts are hot dip galvanized (1.25 oz. coating) where required by ICC reports.

F. Framing Connectors: Simpson Strong Tie Corp., or equal.

2.2 MOISTURE CONTENT

A. 19 percent maximum for two times thickness and less; 19 percent maximum for thickness greater than two times and less than four times; and 22 percent maximum for thickness greater than four times.

2.3 SIZES

A. Surfaced to "DRY" sizes. Sizes noted are nominal unless shown as net.

2.4 SURFACING

A. All wood materials exposed in the finished work shall have re-sawn surfaces of clean natural color unless noted or specified otherwise. Concealed framing lumber shall be S4S.

PART 3 EXECUTION

3.1 ERECTION AND INSTALLATION

A. Framing:
1. Properly lay out framing with pieces closely fitted, accurately plumbed, leveled and aligned, and rigidly secured in place.

B. Except as specifically shown on structural drawings, cutting of all wood, etc. is limited to those cuts permitted by CBC.

C. Bridging and Blocking:

1. Provide two times blocking at intersections of finished surfaces for adequate bearing and at points where required to support fixtures, cabinets, hardware, and other equipment mounted on walls.

D. Plywood (General): Unless more stringent requirements are indicated on the Drawings or required by code, application of plywood shall be in accordance with recommendations of the American Plywood Association.

E. Connections and Fastenings:
1. For bolted connections, provide washers under heads and nuts bearing on wood, and draw nuts tight. Retighten before closing in framing.
2. Exercise care in nailing through exposed sheathing and siding and ensure that fasteners penetrate into framing members

END OF SECTION 06 10 00

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SECTION 06 16 00 - SHEATHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Wall sheathing.
   2. Underlayment.
   3. Sheathing joint and penetration treatment.
   4. Accessories necessary for a complete installation.

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

C. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board; 2020.

D. ASTM C834 - Standard Specification for Latex Sealants; 2017.

E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

F. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

G. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials; 2012 (Reapproved 2020).

H. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).

I. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

L. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.

M. AWPA U1 - Use Category System: User Specification for Treated Wood; 2022.

1.4 SUBMITTALS

A. Product Data:
   1. Technical data for each type of process and factory fabricated product. Indicate component materials and dimensions and include construction and application details:
      a. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
      b. Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.

c. For fire retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
d. For products receiving a waterborne treatment, include statement that moisture content of treated materials reduced to levels specified before shipment to Project site.
e. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

A. Fire Test Response Characteristics:
1. For assemblies with fire resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction:
a. Fire resistance ratings: Indicated by design designations from UL Fire Resistance Directory or GA-600 Fire Resistance Design Manual.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Plywood: DOC PS 1.

B. Oriented Strand Board: DOC PS 2.

C. Thickness: As necessary to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE TREATED PLYWOOD

A. Preservative Treatment by Pressure Process - AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground:
1. Preservative chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE RETARDANT TREATED PLYWOOD

A. Where fire retardant treated materials are indicated, use materials complying with requirements acceptable to authorities having jurisdiction and with fire test response characteristics specified determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire Retardant Treated Plywood by Pressure Process:
1. Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an

additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test:
   a. Use treatment that does not promote corrosion of metal fasteners.
   b. Exterior type: Treated materials shall comply with requirements specified above for fire retardant treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   c. Design value adjustment factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high temperature fire retardant treatment is indicated, span ratings for temperatures up to 170 degrees F (76 degrees C) shall be not less than span ratings specified.

C. Kiln dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire retardant treated plywood with appropriate classification marking of qualified testing agency.

E. Application:
   1. Treat plywood indicated on Drawings and the following:
      a. Roof and wall sheathing within 48 inches (1,220 mm) of fire walls.
      b. Subflooring and underlayment for raised platforms.

2.4 WALL SHEATHING

A. Glass Mat Gypsum Wall Sheathing - ASTM C1177/C1177M:
   1. Product is subject to compliance with requirements; provide products by one of the following:
      a. CertainTeed Corporation: GlasRoc (basis of design).
      b. Georgia Pacific: Dens-Glass.
      c. National Gypsum Company: Gold Bond eXP.
      d. United States Gypsum Co.: Securock.
   2. Type and Thickness: Regular, 1/2 inch (12.7 mm) thick.
   3. Size: Four feet by eight feet (1,220 mm by 2,440 mm) for vertical installation.

2.5 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor Underlayment - DOC PS 1, Exterior, Structural I, C-C Plugged Single Floor Panels:
   1. Span rating: Not less than 20 o.c.
   2. Nominal thickness: Not less than one inch (25 mm).
   3. Edge detail: Tongue and groove.
   4. Surface finish: Fully sanded face.

B. Underlayment: Provide underlayment in nominal thickness not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.

C. Sound Deadening Board - Class C Fire Rated, Molded, Recycled Post-Consumer Paper, Cellulose Fiber Structural Panel:
   1. Density: 26 pcf to 28 pcf (416 = 448 kg/cu.m) tested in accordance with ASTM C209.
   2. Tensile strength - when tested in accordance with ASTM C209:
      a. Parallel: 450 - 700 psi (3,100 - 4,830 kPa).
      b. Transverse: 750 - 1--- psi (5.1171 - 6.894 kPa).
   3. Hardness (Janka Ball): 230 pounds (104 kg) tested in accordance with ASTM D1037.
   4. Water absorption by volume, when tested in accordance with ASTM C209:
      a. Two-hour immersion: Maximum seven percent (7%).
   5. Expansion: 50 percent to 90 percent relative humidity, 0.25 percent in accordance with ASTM C209.

6. Noise reduction coefficient (NCR): 0.20.
7. Flame spread: Maximum 75 tested in accordance with ASTM E84 Class C.
8. Thickness: 3/4 inch (19 mm).

2.6 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture. Provide fasteners with hot dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667/F1667M.

C. Power Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Gypsum Sheathing to Cold Formed Metal Framing:
   1. Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic polymer or corrosion protective coating having salt spray resistance of more than 800 hours according to ASTM B117:
      a. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C1002.

2.7 SHEATHING JOINT AND PENETRATION TREATMENT MATERIALS

A. Sealant for Glass Mat Gypsum Sheathing:
   1. Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass fiber sheathing tape and for covering exposed fasteners:
      a. Sheathing tape: Self-adhering glass fiber tape, minimum two inches (50 mm) wide, ten by ten or ten by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass mat gypsum sheathing and with history of successful in-service use.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three (3) support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint sealant installation so materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions. Fasten gypsum sheathing to cold formed metal framing with screws. Install boards with a 3/8-inch (9.5 mm) gap where non-load bearing construction abuts structural elements. Install boards with a 1/4-inch (6.4 mm) gap where they abut masonry or similar materials that retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation:
   1. Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud:
      a. Space fasteners approximately eight inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer's written instructions. Apply glass fiber sheathing tape to glass mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal penetrations and openings.

END OF SECTION 06 16 00

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SECTION 06 20 00 - FINISH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Providing all finish carpentry items including, but not limited to:
      a. Finish carpentry.
      b. Millwork and cabinetry.
      c. Plastic laminate.
      d. Casework hardware.
      e. Miscellaneous millwork.
   2. Installation of:
      a. Finish hardware.
      b. Plastic laminate faced wood doors.

B. Related Sections:
   1. Section 06 10 00 - Rough Carpentry.
   2. Section 13 34 23.14 - Fabricated Classroom Buildings.

1.3 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s preprinted product information for all hardware proposed on the Project.
   3. Manufacturer’s preprinted maintenance instructions for the casework hardware.

B. Shop Drawings:
   1. Indicate size, material, and finish.
   2. Show locations and installation procedures, including hardware, sinks, service fixtures, trim, and other pertinent data for each unit.

C. Certification: Provide manufacturer’s certification that casework has been fabricated and installed according to WI “Custom” Grade guidelines or better.

D. Samples: Two (2) each, 6 inch by 6 inch by 3/4 inch sample of specified particleboard core with grade stamp for use as verification of installed product.

E. Closeout:
   1. Record drawings: Indicate revisions to original Drawings and shop drawings.
   2. Manufacturer contact names, addresses, and phone numbers.
   3. Finish material schedule: Names and color numbers of laminates and stains.
   4. Keys: Provide additional master key for each room and additional locksets totaling one percent (1%) of total Project for attic stock.

1.5 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated, perform work in accordance with WI “Architectural Woodwork Standards,” Custom Grade, except where specification exceeds those standards the more stringent shall govern.

B. Fabricate millwork and cabinetry in accordance with ANSI A161.1, NEMA LD3, and general static load testing performed and certified by an independent testing agency covering the following areas of product performance, with these minimum results:
   1. Base cabinet construction/racking test: 800 pounds.
   2. Cabinet front joint loading test: 425 pounds.
   3. Wall cabinet static load test: 2,000 pounds.
   4. Drawer front joint loading test: 600 pounds.
   5. Drawer construction/static load test: 750 pounds.
   6. Cabinet adjustable shelf support device/static load test: 300 pounds.

C. Shelf Loading: Comply with loading/deflection standards of the Composite Panel Association.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program.

C. Quality Standard:
   1. Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements:
      a. Before delivery to jobsite, millwork supplier:
         1) Licensees of WI shall issue a certified compliance certificate indicating millwork products being furnished for this Project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
         2) Non-licensees of WI shall provide evidence that they have arranged for inspection by WI inspector after completion of fabrication and installation. If conditions are found to be compliant, inspector will issue Compliance Certificate indicating millwork products being furnished for this Project and certifying that these products and their installation will fully meet requirements of grade or grades specified.
      b. Each elevation of casework and each countertop shall bear certified compliance label.
      c. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.

D. Certified Seismic Installation Program (CSIP):
   1. Before wood or metal stud walls are closed up, provide a written Woodwork Institute CSIP report confirming that acceptable backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located:
      a. Backing shall consist of a minimum of either three by six (3 x 6) flat Douglas Fir or 16-gage 50 KSI sheet metal.
   2. On completion of installation, provide a Woodwork Institute CSIP Certificate identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.
   3. All fees charged by the Woodwork Institute for their CSIP are the responsibility of the millwork installer and shall be included in their bid.

E. Pre-Installation Conference:
   1. See Section 01 31 00 - Project Management and Coordination.

1.7 WARRANTY

A. Warranty the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include but not be limited to the following:
   1. Rough or difficult operation, or loose or missing parts.
   2. Delamination of surfaces.

3. Noticeable deterioration of finish.
4. Warped or misaligned surfaces or telegraphing of subsurface imperfections.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed. Store in ventilated place, protected from the weather, with relative humidity range of 20 to 50 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

PART 2 PRODUCTS

2.1 MILLWORK MANUFACTURERS

A. Woodwork Institute listed Accredited Millwork Companies, current roster and shall not preclude Contractor from using other manufacturers, provided they produce equivalent products of the type specified for the scope and size of the Project. Other manufacturers must have experience manufacturing products meeting or exceeding the specifications and must comply with the criteria performance set by the Woodwork Institute or as indicated in Part 1 of this Section and with Division 01 requirements regarding substitutions.

2.2 MILLWORK MATERIALS

A. Plastic Laminate:
   1. Acceptable Manufacturers:
      a. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
         1) Abet Laminati: abetlaminati.com/#sle.
         2) Formica: www.formica.com/#sle.
         3) Panolam: panolam.com/hpl-high-pressure-laminate/#sle.
         4) Wilsonart: www.wilsonart.com/#sle.
      b. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
   2. High-pressure decorative laminate complying with NEMA LD3, and the following requirements:
      a. PL-1: Plastic Laminate .
         1) Manufacturer: Formica.
         2) Color: Camel Elm 7595.
         3) Finish: Natural Grain.
         4) Location: As indicated on Drawings.
      b. If laminate has wood grain, direction of grain shall be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.
   3. Laminate Grades:
      a. Exposed doors, finished end panels, and other vertical surfaces: GP28 (0.028 inch thick nominal)
      b. Horizontal surfaces other than top: GP28 (0.028 inch thick nominal)
      c. Cabinet Liner: CL20 (0.020-inch nominal), white.
      d. Work surfaces and countertops: GP50 (0.050-inch thick nominal) with BK20 (0.20-inch thick) backer sheet.
      e. Backsplash: PH42 (0.042 inch nominal) with nominally balanced backer sheet.
   4. Adhesive: PVA water resistant adhesive. Contact adhesives not permitted.
   5. Pressure Fused Laminate:
      a. NEMA LD3 VGL, and NEMA LD3 CLS, melamine resin impregnated, 120-gram PSM minimum, thermofused to core under pressure.
      b. Color:

1) Closed interiors, underside of wall cabinets: White.
2) Exposed and semi-exposed open cabinets: Match exterior.

c. Provide balanced construction with same thermofused melamine. Unsurfaced coreboard or simple backers not allowed.

B. Core Material:
1. Particleboard: ANSI 208.1, Grade M-2-Exterior Glue.
2. Medium-density fiberboard: ANSI A208.2, Grade MD.
3. Plywood: Shop sanded, exterior grade veneer cored, hardwood faced, any species, with no defects affecting strength or utility. Overlay plywood not permitted. Plywood allowed at countertops and toe-base only.
4. Water resistant treated plywood shall have 24-hour thickness swell factor of five percent (5%) or less and 24-hour water absorption factor of ten percent (10%) or less; P.S. 51, Type II or better.
5. Cabinet components shall be of the following minimum core thicknesses:
a. Cabinet backs, drawer body, and drawer bottoms: 1/2-inch particleboard.
b. Door and drawer face, base, wall, and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, cabinet back rear hangstrips, structural dividers, and exposed cabinet backs: 3/4 inch particleboard.
c. Work surfaces and countertops: Minimum 1 inch particleboard or plywood, except use water resistant treated plywood core at counters with sinks.
d. Shelves: 3/4 inch particleboard core for 30 inches long or less, 1 inch thick particleboard core for more than 30 inches long; 14-inch deep, unless otherwise noted. Provide vertical dividers for shelves over 36 inches long.
e. Cabinet toe-base: 3/4 inch plywood. No particleboard within 3 inches of floor.

C. Countertops:
1. Refer to Section 12 36 00 - Countertops.

D. Toe Spaces:
1. Leave toe spaces unfinished for installation of resilient base, unless otherwise shown.

E. End Panels and Filler Strips:
1. Match adjacent case-piece.

F. Edging:
1. Provide the following in accordance with “Edging Locations:”
a. Flat edge PVC: 0.020 inch. Solid, high-impact, purified, color-thru, acid resistant, machine-applied with hot melt adhesives.
b. Three-millimeter (3 mm) PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, and machine profiled to 1/8-inch radius.
2. Edging Locations:
a. Cabinet body edge, including door/drawer front spacer rail: Flat edge PVC, color matched to door/drawer face or as selected.
b. Forward edge of interior body components, interior dividers, shelf, and top edges of drawer body: Flat edge PVC to match cabinet interior surface color.
c. Door/drawer-front edging: Three-millimeter (3 mm) PVC, color matched to standard laminates.

2.3 CABINET HARDWARE

A. All hardware shall meet ANSI A156.9 and shall be subject to approval by the Architect. All keying shall match existing master key system and be approved by the Owner:
1. Acceptable manufacturers:
a. Knape & Vogt.
b. As specified herein, provide specified product, or Architect approved equal.

B. Hinges:

1. Heavy duty, five-knuckle 2-3/4-inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, Teflon coated tight pin feature with all edges eased. Hinge shall be full wrap around type of tempered steel 0.095 inch thick. Each hinge shall have minimum of nine (9) screws, #7, 5/8-inch FHMS to assure positive door attachment.
2. One (1) pair per door to 48 inches height. 1-1/2 pair over 48 inches in height. Hinge shall accommodate 13/16 thick laminated door and allow 270-degree swing.
3. Finish: US26D.

C. Pulls:
1. Wire design, four inches (4”), satin chrome, US26D finish.

D. Sliding Door Hardware:
1. Frameless 1/4-inch glass sliding doors; double track rolling door assembly.
2. Framed 13/16-inch thick stile and rail sliding doors; top mounted track with dual roller hangers. Vertical adjustment for accurate alignment.

E. Drawer Slides:
1. Standard drawers: 3/4 extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 100-pound dynamic load rating at full extension.
2. File drawers: Full extension, three-part progressive opening slide, precision steel ball bearing, minimum 100-pound dynamic load rating at full extension, zinc plated or epoxy coated at manufacturer’s option.
3. Provide body mounted molded rails for hanging file system for legal or letter size as indicated by manufacturer’s model number. Cutting or machining of drawer body/face not permitted.
4. Paper storage drawers: Full extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 150-pound dynamic load rating at full extension.

F. Catches:
1. Provide opening resistance in compliance with the Americans with Disabilities Act:
   a. Provide top-mounted magnetic catch for base and wall cabinet door.
   b. Provide two (2) at each tall cabinet door. Catch housing shall be molded in White.

G. Adjustable Shelf Supports:
1. Dual-pin design with anti-tip-up shelf restraints for both 3/4 inch and 1 inch shelves.
2. Include keel to retard shelf slide-off, and slot for mechanical attachment of shelf to clip.
3. Load rating shall be minimum 300 pounds each support without failure.
4. Basis of Design: Products manufactured by Knape and Vogt.
   a. Standard: Model 255 Steel.
   b. Supports: Model 256.

H. Wardrobe Rod: 1-1/6 inch diameter plated steel rod, with captive sockets.

I. Coat Hooks: Single and double prong, wall mount - satin aluminum.

J. Locks: Five-disk tumbler cam-style with strike. Locks on cabinets in same room keyed alike. Provide two (2) keys per room where doors and drawers are scheduled to receive locks. Dull chrome finish. Lock core shall be removable with a control key, permitting Owner to change lock arrangements without tools.

2.4 SPECIALTY ITEMS

A. Grommets:
1. Approved Product/Manufacturer: Model No. EDP3 manufactured by Doug Mockett & Company, Inc. (basis of design), Manhattan Beach, CA; (800) 523-1269, or Architect approved equal.
2. Size: 2-1/2 inches diameter with “Flip-Top”™ tab in cap.
3. Colors: As selected by Architect from manufacturer’s available colors.

4. Number/location: Where electrical, telephone, and computer data wiring need to pass through tops whether shown or not.

B. Keyboard Drawers (at all knee spaces):
   1. Approved product/manufacturer: No. SD-1 as manufactured by Knape & Vogt; or Architect approved equal.

C. Molded Personal Pencil Drawer: High-impact 100 Polystyrene with in-stop, out-stop, and self-closing features. Provide under top mounted 100-pound self-closing slides. Twelve (12) compartment drawer body, and slides, black. Provide where indicated on plans.

D. Mailbox Label Holder: Brass, card size 1/2-inch by 2-3/16 inches. Provide one (1) at each opening.

2.5 SOLID STOCK

A. Moisture Content: Percent of moisture in relation to over-dry weight shall be between eight percent (8%) and 13 percent at time of installation.

B. Natural Finish Hardwood:
   1. Occasional knot permitted provided it is tight and smooth.
   2. Grain pattern: Rift-cut.
   3. Species: WI "Premium" Grade, White Oak.

C. Paint Grade Hardwood: Any species, including Parana Pine, except do not use oak, elm, or similar species that have coarse grain.

2.6 MISCELLANEOUS

A. Utility Shelving: WI "Economy" grade.

B. Telephone/MDF/IDF Board: Provide minimum four foot by eight foot by 3/4 inch (4’ x 8’ x 3/4”) thick plywood for telephone/data punch down blocks and video equipment in accordance with Section 06 10 00: Rough Carpentry. Paint in accordance with Section 09 90 00: Painting and Coating.

2.7 MILLWORK FABRICATION

A. Use the WI Custom Grade woodwork classification unless noted elsewhere complying with referenced quality standard.

B. Fabricate casework, countertops, and related products to dimensions, profiles, and details shown on Drawings. Fabricate casework square, plumb, and true.

C. Detailed Requirements for Cabinet Construction:
   1. Toe-Base:
      a. Continuous, ladder type platform with concealed fastening to cabinet bottom, level and secured to floor.
      b. Toe-base at exposed cabinet end panels shall be recessed 1/4 inch from face of finished end for flush installation of finished base material.
      c. No cabinet sides-to-floor will be allowed.
   2. Cabinet Top and Bottom:
      a. Solid sub-top shall be furnished for all base and tall cabinets.
      b. At cabinets over 36 inches, bottoms and tops shall be mechanically joined by a fixed divider.
      c. Assembly devices shall be concealed on bottom side of wall cabinets.
   3. Cabinet Sides:
      a. Doweled, and glued under pressure, or attached with fully concealed interlocking mechanical fasteners to sub-top and bottom.
      b. Drill holes for adjustable shelves 1-1/4 inch on center.
   4. Cabinet Backs:
      a. Side bound, captured in grooves, recessed from cabinet rear, and securely fastened at top and bottom.

b. Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of two (2) at base, two (2) at wall, and three (3) at tall cabinets as instructed by casework manufacturer.
c. Provide removable back panels and closure panels for plumbing access at all sink cabinets, and where shown on Drawings.

5. Exposed end corner and face frame attachment:
   a. Butt joint, glued and finish nailed; or attached with fully concealed interlocked mechanical fasteners.
6. Door and Drawer Fronts:
   a. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8 inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
   b. Where indicated, provide stile and rail doors with full 1/4 inch plate glass, hinged or sliding. Exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.
   c. Where indicated, frameless sliding glass doors shall be 1/4 inch thick plate glass with ground and polished edges. Fit with anodized aluminum shoes and nylon rollers.

D. Drawers:
1. Drawer fronts: Apply to separate drawer body component sub-front.
2. Drawer sides: Doweled to receive front and back, glued under pressure, machine squared.
3. Drawer bottom: Set into front and sides, 1/4 inch deep groove with minimum 3/8 inch standing shoulder, continuously glued. Reinforce drawer bottoms with 1/2 inch by 4 inch front-to-back intermediate underbody stiffeners, mechanically fastened. One (1) at 24 inches, two (2) at 36 inches, and over.
4. Paper Storage Drawers: Fitted with full width hood at back.
5. Hanging file drawers shall be fabricated to accept letter size hanging folders compatible with Pendaflex system.

E. Vertical and Horizontal Dividers: As required by manufacturer for type and style of component.

F. Door/Drawer Front Rail: As required by manufacturer for type and style of component, and hardware placement.

G. Accessibility Requirements - 2019 California Building Code, Section 11B:
1. The following special requirements shall be met, where specifically indicated on architectural Plans as “accessible” or by general note. Shall be in compliance with California title 24 access:
   a. Countertop height: With or without cabinet below, not to exceed a height of 34 inches above finished floor (A.F.F.), at a surface depth of 24 inches.
   b. Knee space clearance: Minimum 27 inches A.F.F. at apron, and 30 inches clear span width (11B-306.3).
   c. Sink cabinet clearances: In addition to above, upper knee space frontal depth shall be no less than eight inches (8”), and lower toe frontal depth shall be no less than 11 inches, at a point nine inches (9”) A.F.F., and as further described in 11B-306.

H. Typical Desk or Counter Height at Knee Space Locations: 30 inches A.F.F.

PART 3 EXECUTION

3.1 JOB CONDITIONS

A. Environmental Requirements:
1. Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least one (1) week:
   a. Manufacturer/supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
   b. After installation, control temperature and humidity to maintain relative humidity between 25 and 55 percent.

B. Conditions: Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

3.2 COORDINATION

A. Coordinate the work of this Section with plumbing work specified in Division 22. Coordinate sink opening construction with sinks specified in Division 22 or as indicated on Drawings.

B. Coordinate location of blocking in walls for installation and support of wall cabinets.

3.3 MILLWORK INSTALLATION

A. Positioning: Place approximately level, plumb, and at right angles to adjacent work.

B. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging the products and adjacent work.

C. Anchorage: Attach securely so the products will perform to their maximum ability without damage from inadequate fastenings.

D. Fasten tops to frames with concealed clips, screws, and glue.

E. Install simulated wood trim in locations shown on Drawings and in accordance with manufacturer's instructions.

3.4 EXISTING DOOR LAMINATE RESURFACING

A. Resurfacing procedures shall be in accordance with the recommendations and instructions of the laminate and adhesive manufacturers.

B. Acclimate laminate to the same environment as existing material at least 48 hours. Perform work in well-ventilated area, out of the way of construction dust and traffic to maintain clean adhesion.

C. Clean the substrate with detergent or non-flammable solvent as instructed by laminate manufacturer to remove wax, grease, and polish deposits.

D. Using a belt sander or sander instructed by manufacturer, sand entire surface to remove original finish. Remove sanding dust thoroughly.

E. Coat the sanded surface and back of laminate with a uniform coating of contact adhesive. Allow to dry thoroughly prior to assembling. Assembling wet adhesive lines will trap solvent and may result in poor bonding. Follow the adhesive manufacturer's instructions.

F. Index the laminate with the substrate. Make initial contact by smoothing with palms. Apply pressure using a "J" roller or rotary press. Allow to set as instructed by adhesive manufacturer to achieve full adhesion to maintain warranty. Trim with recommended tools.

G. Apply laminate to door faces and exposed vertical edges. Apply edges before face. Paint top and bottom edges to color match facing.

H. Coordinate hardware and vision lite cutouts with work of other Sections.

3.5 FINISH HARDWARE INSTALLATION

A. The supplier will mark each item of hardware for location. Protect the markings until each item is installed. If any item is delivered to the job not properly marked, return it to the supplier for marking before attempting to install it.

B. Check markings on hardware for proper location. Install and make necessary adjustments for proper working order. Any hardware damaged by improper adjustment or careless abuse will be replaced by Contractor at his expense.

C. Provide clean, properly sized, and accurately placed mortises and drilled holes for all mortise hardware such as locksets and for cylindrical locks where specified only.

D. Fit all surface-applied hardware accurately.

E. After hardware is installed, protect exposed surfaces by use of heavy paper and masking tape and maintain until job completion.

F. Remove all finish hardware except that which is primed for painting before painter's finish is applied. Permanently replace and re-adjust for proper function after painter's finish has dried hard.

G. Millwork Contractor shall be responsible for hardware on millwork.

3.6 PLASTIC LAMINATE FACED WOOD DOOR INSTALLATION

A. Protect all doors during handling.

B. Install doors in accordance with manufacturer’s instructions.

C. Install and adjust doors for smooth, quite operation.

D. Refer to Section 08 81 00 Door Hardware where applicable.

END OF SECTION 06 20 00

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SECTION 06 83 16 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Glass fiber reinforced plastic paneling (FRP).
   2. Trim accessories.
   3. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 06 10 00: Rough Carpentry.
   2. Section 07 92 00: Joint Sealants.
   3. Section 09 21 16: Gypsum Board Assemblies.

1.3 REFERENCE STANDARDS

A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

1.4 SUBMITTALS

A. Product Data: Technical data including supporting documentation of compliance with surface burning characteristics for FRP and accessories.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements of the 2019 CBC for interior plastic materials and interior wall finishes.
   2. Surface burning characteristics:
      a. Determined by testing identical products according to ASTM E84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency:
         1) Flame spread index: 25 or less.
         2) Smoke developed index: 450 or less.

B. Source Limitations: Obtain FRP and trim accessories from single manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Glass Fiber Reinforced Plastic Paneling:
   1. Gelcoat finished, glass fiber reinforced plastic panels complying with ASTM D5319:
      a. Provide USDA accepted panels for incidental food contact.
      b. Manufacturers are subject to compliance with requirements; provide products by one of the following:
         1) Crane Composites, Inc.
         2) Glasteel. (Basis of Design).
         3) Marlite, 1 Marlite Dr, Dover, OH 4462. Ph: 800-377-1221. www.marlite.com
         4) Nudo Products, Inc.
         5) Parkland Plastics, Inc.
      c. Nominal thickness: Not less than 0.09 inch (2.3 mm).
      d. Surface finish: Pebbled.
      e. Color: Bright White.

2. Basis of Design: Products as manufactured by Marlite.

2.2 ACCESSORIES

A. Trim Accessories:
   1. One-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges:
      a. Color: As selected by Architect.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, where applicable, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by FRP manufacturer.

E. Sealant: Mildew resistant, single component, neutral curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00: Joint Sealants.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

3.2 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels so that trimmed panels at corners are not less than 12 inches (300 mm) wide:
   1. Mark plumb lines on substrate at trim accessory panel joint locations for accurate installation.
   2. Locate trim accessories panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.4 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned:
   1. Drill oversized fastener holes in panels and center fasteners in holes.
   2. Apply sealant to fastener holes before installing fasteners.

D. Install factory laminated panels using concealed mounting splines in panel joints.

E. Install trim accessories with adhesive and nails; no staples. Do not fasten through panels.

F. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 83 16

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SECTION 07 16 00 - BELOW GRADE WATERPROOFING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation of concrete surfaces to receive waterproofing membrane.

B. Sealing of cracks and joints.

C. Fluid applied waterproofing system, with prefabricated drainage composite or protection board at walls that fall below grade (auditorium, basement, elevator pit, etc.).

D. Pre-applied waterproofing system, with joint sealing tape, and other accessories at below grade horizontal surfaces under the slab or elevator pit.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete

B. Section 07 92 00 - Building Sealants

C. Division 23 - Mechanical: Mechanical penetrations, such as floor drains and piping, through waterproofing membrane.

D. Division 26 - Electrical: Electrical penetrations, such as conduit, through waterproofing membrane.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.

B. Certifications:
   1. Manufacturers certification that applicator is approved by Manufacturer.
   2. Manufacturer’s affidavit that materials used in Project contain no asbestos.

C. Warranty: Submit a sample warranty identifying the terms and conditions stated in warranty.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator shall be experienced in applying the same or similar materials and shall be specifically approved in writing by the membrane system Manufacturer.

B. Regulatory Requirements: Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).

1.5 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 – Project Coordination

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials job site in original, factory-sealed, unopened containers bearing Manufacturer's name and label intact and legible with following information.
   1. Name of material.
   2. Manufacturer's stock number and date of manufacture.
   3. Material safety data sheet (MSDS).

B. Store and handle in strict compliance with Manufacturer’s instructions, recommendations and material safety data sheet (MSDS).

C. Protect from damage from sunlight, weather, excessive temperatures and construction operations.

D. Remove damaged material from the site and dispose of in accordance with applicable regulations.

E. Do not double-stack pallets of waterproofing on the job site. Provide cover on top and all sides.

F. Store drainage composite and protection board flat and off the ground. Provide cover on top and all sides.

G. Protect waterproofing materials from freezing. In cool temperatures, store the material for several hours at room temperature to facilitate mixing and application.

H. Sequence deliveries of materials to avoid delays but minimize on-site storage.

1.7 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the Manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive membrane waterproofing.

C. Coordinate waterproofing work with other trades to ensure adequate illumination, ventilation, and dust-free environment during application and curing of membrane. The applicator shall have sole right of access to the specified areas for the time needed to complete the application and allow the membrane to cure adequately.

D. Protect adjoining surfaces not to be coated against damage or soiling. Protect plants, vegetation and animals which might be affected by waterproofing operations.

E. Warn personnel against breathing of vapors and contact of material with skin or eyes. Wear applicable protective clothing and respiratory protection gear.

F. Keep products away from spark or flame. Do not allow the use of spark producing equipment during application and until all vapors have dissipated. Post "NO SMOKING" signs.

G. Maintain work area in a neat and orderly condition, removing empty containers, rags, and rubbish daily from the site.

1.8 WARRANTY

A. Warrant the work specified herein for ten (10) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.

PART 2 - PRODUCTS

2.1 FLUID APPLIED WATERPROOFING SYSTEM - POST APPLIED

A. Specifications are based on named Manufacturer's products and systems listed below. Other Manufacturers must have a minimum of five (5) years' experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
1. AVM Industries, Inc. Canoga Park, CA (AVM Aussie Membrane 500)
2. Carlisle Coatings and Waterproofing Incorporated, Wylie, TX (Barricoat)
3. GCP Applied Technologies, Cambridge, MA (Procor)
4. W. R. Meadows, Inc., Hampshire, IL (Mel-Rol LM)

B. Fluid Applied Waterproofing Membrane: Water-based rubber and / or bitumen liquid / fluid applied waterproofing membrane modified with high performance rubberized polymers and special additives for use in vertical seamless applications.

Waterproofing Membrane Physical Properties, minimum:

Property	Test Method	Typical Value
Cured / Dry Film Thickness	ASTM D3767	60 mils
Solids Content	---	62%
Low Temp Flexibility	ASTM C836	Pass
Elongation	ASTM D412	500%
Pliability	ASTM D1970	Unaffected
Resistance to Standing Water	ASTM D2939	Pass

C. Accessory Products:
1. Protection Coarse: Prefabricated drainage composite material designed to promote positive drainage while serving as a protection course. Provide product consisting of an impermeable polymeric sheet cuspated under heat and pressure to form a high flow dimpled drainage core with a bonded layer of nonwoven filter fabric.

D. Locations: Vertical below-grade structural concrete foundation walls opposite conditioned and habitable areas that fall below grade 0'-0" and where shown on drawings.

2.2 SHEET APPLIED WATERPROOFING SYSTEM - POST APPLIED

A. Specifications are based on named Manufacturer's products and systems listed below. Other Manufacturers must have a minimum of five (5) years' experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.

1. Carlisle Coatings and Waterproofing Incorporated, Wylie, TX (MiraDRI 860/861)
2. W. R. Meadows, Inc., Hampshire, IL (Mel-Rol)

B. Sheet Applied Waterproofing Membrane: Self-adhering sheet membrane consisting of rubberized asphalt laminated to a polyethylene film.

Waterproofing Membrane Physical Properties, minimum:

Property	Test Method	Typical Value
Thickness	ASTM D3767	60 mils
Low Temp Flexibility	ASTM D1970	Pass
Elongation	ASTM D412	350%
Puncture Resistance	ASTM E154	50 lbf
Hydrostatic Head	ASTM D5385	230 ft

C. Accessory Products:
1. Primer: Manufacturer's recommended spray or roller applied water-based adhesive.
2. Detail Sealant: Manufacturer's recommended sealant material for use at penetrations, cut edges, top edge terminations, transitions, etc. and adhesion for the protection course.
3. Detail Strip: Manufacturer's recommended waterproofing membrane material.
4. Protection Coarse: Prefabricated drainage composite material designed to promote positive drainage while serving as a protection course. Provide product consisting of an impermeable polymeric sheet cuspated under heat and pressure to form a high flow dimpled drainage core with a bonded layer of nonwoven filter fabric.
5. Termination Bar: High strength, pre-formed, multi-purpose plastic strip with holes 6" o.c.

D. Locations: Vertical and horizontal below-grade structural concrete foundation walls opposite conditioned and habitable areas that fall below grade 0'-0" and where shown on drawings.

2.3 SHEET APPLIED WATERPROOFING SYSTEM - PRE-APPLIED

A. Specifications are based on named Manufacturer's products and systems listed below. Other Manufacturers must have a minimum of five (5) years' experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
1. AVM Industries, Inc. Canoga Park, CA (AVM Aussie Skin 550G)
2. GCP Applied Technologies, Cambridge, MA (Preprufe 200)

B. Sheet Waterproofing Membrane: Composite sheet comprising a heavy duty, puncture resistant, HDPE film, an aggressive pressure sensitive adhesive and a weather resistant protective coating. Membrane provides a continuous seal that resists water ingress and migration between the membrane and the structure.

C. Accessory Products:
1. Pressure Sensitive Tape: Two-sided, reinforced, pressure sensitive tape constructed with a highly aggressive adhesive. Material to form a continuous and integral seal to the structure (GCP Prefrufe CJ Tape).
2. Detail Sealant: Manufacturer's approved sealant intended for use sealing around penetrations.

D. Locations: Vertical below-grade structural concrete foundation walls opposite conditioned and habitable areas as well as horizontal surfaces below the slab that fall below grade 0'-0" and where shown on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before waterproofing work is started the all surfaces to be waterproofed shall be thoroughly examined for all deficiencies. Should deficiencies exist, the Architect shall be notified in writing and corrections made.

3.2 SURFACE PREPARATION

A. Surfaces to which waterproofing is to be applied shall be thoroughly clean, dry and free from all surface contaminates or cleaning residue that may harmfully affect the adhesion of the membrane.

B. Repair all cracks in accordance with Manufacturer's instructions.

3.3 APPLICATION

A. Priming: Shall be in accordance with membrane Manufacturer's instructions.

B. Apply waterproofing in accordance with membrane Manufacturer's instructions.

C. Liquid membrane waterproofing on vertical walls shall positively overlap turned up sheet membrane waterproofing from under slab as instructed by the Manufacturer.

D. Where shown or required, install specified perimeter drainage system as the first course of drainage composite immediately after membrane has cured on vertical surfaces. Install Manufacturer's recommended drainage composite or protection board / protection course on remainder.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Double layer, roofing insulation system.
   2. Extruded polystrene foam board
   3. Polyisocyanurate foam plastic board.
   4. Thermal insulation.
   5. Acoustical insulation (Sound Attenuation).
   6. Glass fiber blanket.
   7. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry.

B. Section 07 81 00 - Applied Fireproofing.

C. Section 09 21 16 - Gypsum Board Assemblies.

D. Section 09 51 00 - Acoustical Ceiling Panels.

E. Division 23 – Mechanical: Duct Insulation.

1.5 SUBMITTALS

A. Product Data: Technical data and installation instructions for each type of insulation product specified.

B. Samples: Six (6) inch x six (6) inch piece of rigid insulation for Architect’s approval.

C. Certifications:
   1. Manufacturer’s certification of compatibility of rigid insulation with dampproofing mastic.
   2. Manufacturers affidavit that materials used in Project contain no asbestos.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Performance Characteristics: Identify products with appropriate markings of applicable testing and inspecting organization.
      a. Surface Burning Characteristic: ASTM E 84.
         1) Flame Spread Index: Maximum 25.
         2) Smoke Developed Index: Maximum 450.
      b. Fire Resistance Ratings: ASTM E 119.
      c. Combustion Characteristics: ASTM E 136.
   2. National Fire Prevention Association (NFPA) 255 Test of Surface Burning Characteristics of Building Materials.
   3. Underwriter's Laboratories (UL) 723 Tests for Surface Burning Characteristics of Building Materials.

B. Cellulose Insulation Manufacturer: Manufacturer having minimum 5 years documented experience and ISO 9002 Certified.
   1. Manufacturer shall provide independent laboratory follow up inspection services of Underwriters Laboratory and Factory Mutual. Label each bag accordingly.

C. Cellulose Insulation Applicator: Applicator having minimum 5 years documented experience and licensed by manufacturer.

D. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of Work.

E. Environmental Requirements: Manufacture extruded polystyrene with HCFC or other CFC free blowing agents. Mark insulation boards and packages with manufacturer's name and product designation. Unmarked boards and packages will be rejected.
   1. Wherever possible, provide boards from manufacturers who recycle insulation materials.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam plastic board insulation:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.8 PROJECT CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

B. Sequence Work to ensure fireproofing and firestop materials are in place before beginning Work.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS/PRODUCTS

A. Specifications are based on any of the manufacturers listed below, with their product in parenthesis for the particular insulation application. Other manufacturers not listed must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 1 regarding substitutions to be considered.
   1. ROOF INSULATION SYSTEM

B. System shall have an insulation R-value of 30 and an installed thickness of 8 inches. Roof system shall be a double layer system. A thermal block shall be applied where there is no existing thermal break. The Thermal break shall be 1 inch Snap-R™ thermal block. System components shall meet the following minimum specifications:
   1. Steel Strap:
      a. 80 KSI tempered, high-tensile-strength steel, galvanized, primed and painted the specified color on the exposed side. Minimum size shall be 0.015 x 3/4 inch x continuous length.
      b. The strap color shall be: White.
   2. Fasteners:
      1) #12 x 3/4 inch plated Tek 2 screws, up to 1/4 inch thick, painted to match the specified color for light gauge steel.
      2) #12 x 1-1/4 inch plated Tek 4 screws painted to match the specified color for heavier gauge steel, up to 3/8 inch thick.

3) Special fasteners for wood, concrete and other structure types as recommended by manufacturer shall be used when appropriate.

3. Liner Fabric:
   a. Shall be woven reinforced high-density polyethylene yarns coated on both sides with a continuous white polyethylene film. The fabric shall have a flame spread index of 25 or less and smoke density index of 50 or less based on ASTM E84 test standards. This material shall be manufactured in large custom pieces by extrusion welding from roll goods. Pieces shall be fabricated to substantially fit the large defined building areas with minimum practical sealing to be done on job site. Fabric shall be folded to allow for rapid pullout on the strap support system.
   b. Liner fabric perm rating shall be: 0.025 grains/hr · sq. feet (based on ASTM E 96, procedure B, “non-inverted water method.”)
   c. Fabric grade and color shall be: Standard white.
4. Sealants: Shall be manufacturer’s extruded fast-tack solvent-based vapor barrier sealant, synthetic rubber adhesive for sealing vapor barrier laps and/or pressure sensitive 3/4 inch wide by 1/32 inch thick extruded vapor barrier sealant.
5. Insulation:
   a. Shall be fiberglass blanket or batt insulation meeting Federal specifications HH-1-588B, Form B, Type 1 or other insulation form as may be recommended and submitted by the system manufacturer and approved by the Architect during submittals.
   b. Insulation shall be installed in two (2) layers with the lower level being 5 inches thick and the upper level being 3 inches thick for a total R-Value of 30.
6. Insulation Hangers: Shall be manufacturer’s “FAST-R” hangers for supporting insulation between wall girts and roof purlins if roof pitch is over 4:12.
7. Thermal Break (Block): Thermal break shall be: Manufacturer’s 1 inch polystyrene “Snap-R” thermal block. The selection shall be provided as thermal break where there is no existing thermal break.
8. Retention Netting: Galvanized poultry wire netting of size and type recommended to suit application.

C. Approved Manufacturer: Insulation system shall be “Simple Saver System” as manufactured by Thermal Design Inc., Madison, NE; (800) 255-0776, or comparable product approved by
   1. Architect.

2.2 EXTRUDED POLYSTRENE FOAM BOARD

A. Extruded, Polystyrene Foam Board: ASTM C578, Type IV.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Chemical Company (The).
      b. Owens Corning.
      c. Comparable product.

2.3 POLYISOCYANURATE FOAM PLASTIC BOARD

A. Polyisocyanurate Board, Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Atlas Roofing Corporation.
      b. Hunter XCI
      c. Dow Chemical Company (The).
      d. Owens Corning.
      e. Firestone Building Products.
      f. Rmax, Inc.
   2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.4 THERMAL INSULATION

A. Themal Insulation, Unfaced: ASTM C 665, Type I. with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Guardian Building Products, Inc.
      c. Johns Manville; a Berkshire Hathaway company.
      d. Knauf Insulation.
      e. Owens Corning.
   2. Thickness/R- Values (minimum):
      a. 3-1/2 inches/ R-11 where shown on the Drawings.
      b. 6 inches/ R-19 where shown on the Drawings.

2.5 ACOUSTICAL INSULATION (SOUND ATTENUATION)

A. Acoustical Insulation (Sound Attenuation), Unfaced: ASTM C 612, Type I. with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Guardian Building Products, Inc.
      c. Johns Manville; a Berkshire Hathaway company.
      d. Knauf Insulation.
      e. Owens Corning.
   2. Thickness/R- Values (minimum):
      a. 3-1/2 inches/ R-11 where shown on the Drawings.
      b. 6 inches/ R-19 above lay-in ceiling specified and where shown on Drawings.

2.6 GLASS FIBER BLANKET

A. Glass Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Guardian Building Products, Inc.
      c. Johns Manville; a Berkshire Hathaway company.
      d. Knauf Insulation.
      e. Owens Corning.

2.7 INSULATION FASTENERS

A. Adhesively Attached, Spindle Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
   2. Spindle: Coppercoated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

B. Adhesively Attached, Angle Shaped, Spindle Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Angle: Formed from 0.030 inch (0.762 mm) thick, perforated, galvanized carbon steel sheet with each leg 2 inches (50 mm) square.

2. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

C. Insulation Retaining Washers: Self-locking washers formed from 0.016 inch (0.41 mm) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
   1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
      a. Crawl spaces.
      b. Ceiling plenums.
      c. Attic spaces.

D. Insulation Standoff: Spacer fabricated from galvanized mild steel sheet for fitting over spindle of insulation anchor to maintain air space of 2 inches (50 mm) between face of insulation and substrate to which anchor is attached.

E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.8 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Glass Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame spread and smoke developed indexes of 5, per ASTM E 84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Asphalt Coating for Cellular Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

B. Foam in Place Insulation: Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
   1. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Board Insulation: Install insulation that is undamaged, dry, and unsoiled and has not been exposed to ice, rain, or snow at any time.
   1. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
   2. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

C. Batt Insulation (Thermal and Sound): Walls: Insulation shall be friction fit between studs and provide full coverage where indicated on Drawings. Insulation shall be tight within spaces n partitions, around cut openings, behind and around electrical and mechanical items within or

behind partitions and tight to items passing through partitions. Wall areas above ceiling: At side wall insulation in ceiling cavity, install adhesive-mounted impaling devices with metal caps at 2 feet-0 inches vertically and at four (4) inches from each side of blankets horizontally. Install blankets with four (4) foot dimension running vertically on spikes, keeping blankets tight to exterior wall without crushing into each other.

D. Cavity Wall Insulation: Foam Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
   1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 - "Unit Masonry."
   2. Cellular Glass Board Insulation: Install with closely fitting joints using attachment method according to manufacturer's written instructions.

E. Framed Construction: Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. For metal framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   6. For wood framed construction, install blankets according to ASTM C 1320 and as follows:
      a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
   7. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
      a. Glass Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

F. Curtain Wall: Install board insulation in curtain wall construction according to curtain wall manufacturer's written instructions.
   1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
   2. Install insulation to fit snugly without bowing.

G. Reflective Insulation: Install sheet reflective insulation according to ASTM C 727.
   1. Install sheet radiant barriers according to ASTM C 1744.
   2. Install interior radiation control coating system according to ASTM C 1321.

H. Roofing Insulation: Install insulation concurrently with installation of roof panels in accordance with manufacturer's directions. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Locate insulation on underside of roof sheets, extending across the top flange of purlin members and held taut and snug to roofing panels with retainer clips. Install retainer strips at each longitudinal joint, straight and taut, nesting with roof rib to hold insulation in place.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

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SECTION 07 21 63 – FLUID-APPLIED INSULATIVE COATING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Spray-applied insulative coating including primer, insulative coating and topcoat for the following applications:

1. Applied to steel penetrating the exterior envelope, from 24 inches (61 cm) outboard of the face of the wall to 24 inches (61 cm) inside the face of metal framing.
2. Applied to the interior of aluminum window frames, on top of exposed framing.
3. Applied to concrete slab edges.

1.2 RELATED REQUIREMENTS

A. Section 05 12 00 Structural Metal Framing.

B. Section 05 50 00 Metal Fabrications.

C. Section 09 96 00 High-Performance Coatings.

1.3 REFERENCES

A. American Institute of Steel Construction (AISC)

1. AISC 303, Section 10 – Erection and storage of coated material during shipment and site handling shall be protected to minimize field touch up.

B. ASTM International

1. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM C1057 – Standard Practice for Determination of Skin Contact Temperature from Heated Surfaces Using a Mathematical Model and Thermesthesiometer.
4. ASTM D870 – Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
5. ASTM D4060 – Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
6. ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
7. ASTM D4585 – Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.
8. ASTM D4587 – Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
9. ASTM D4624/ISO 4624 – Standard Test Method for Bond Strength
10. ASTM D5894 – Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet).

11. ASTM D638 – Standard Test Method for Tensile Strength
12. ASTM D695 – Standard Test Method for Compressive Strength
13. ASTM D790 – Standard Test Method for Flexural Strength
14. ASTM D2240 – Standard Test Method for Determining Durometer Hardness
15. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

C. Association of the American Walls and Ceilings Industries (AWCI)

D. Underwriters Laboratory (UL):

1. UL 263: Standard for Fire Tests of Building Construction and Materials.

E. The Society of Protective Coatings (SSPC)

1. SSPC-SP6: Commercial Blast Cleaning Standard
2. SSPC-SP12: Surface Preparation and Cleaning of Metals by. Waterjetting Prior to Recoating.
3. SSPC-PA1: Shop, Field, and Maintenance Painting of Steel.
4. SSPC-PA2: Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.4 SYSTEM DESCRIPTION

A. The liquid applied thermal break acrylic material shall be applied at the required thickness specified by the manufacturer in order to mitigate thermal bridging. In no case shall the K-value of the liquid applied thermal break be more than 0.040 W/mK.

1.5 SUBMITTALS

A. Product Data: Submit product data including manufacturers technical data indicating product performance characteristics, performance and limitation criteria.

B. Manufacturer’s Instructions: Submit manufacturer written installation instructions.

C. Applicator Qualifications: Submit applicators current certification as a manufacturer trained applicator.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Company specializing in manufacturing product in this section with a minimum of 2 years documented experience in manufacturing insulative technology.
2. Applicator: Company specializing in applying the work of this section with documented experience and trained by the manufacturer.
3. Fluid-Applied Thermal Break Acrylic system shall be the complete system from a sole source consisting of primer, acrylic thermal break material and topcoat. All materials shall be LEED Version 4 compliant.

B. Mock-up:

1. Minimum thirty days prior to application in any area, provide mock-up Samples of thermal break materials in accordance with the following requirements:

    a. Provide minimum two square feet (.18 square meter) on representative substrate, where directed by the Engineer, for each different thickness and finish of required for the work.
    b. Provide mock-up areas that comply with thickness, density application, finish texture, and color.
    c. Inspect mock-up areas within one hour of application for variance due to shrinkage, temperature, and humidity.
    d. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary to meet required installation, finish, and color requirements.
    e. Continue to provide mock-up areas until acceptable areas are produced.
    f. Acceptable areas shall constitute standard of acceptance for method of application, thickness, finish texture, and color requirements, for fluid applied thermal break material applications.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and label

B. Storage: Materials shall be stored in strict accordance with manufacturers documented instructions.

C. Documentation: All batch number, product identification and quantities shall be recorded on appropriate QC documents. A copy of the transport document and manufacturers conformance certificate shall be attached to the material delivery on site.

1.8 FIELD CONDITIONS

A. Project Environmental Requirements: Substrate and air temperature shall be in accordance with the manufacturers' requirements.

1. Protect work area from windblown dust and rain. Protect adjacent areas from over spray of material.
2. Provide ventilation in areas to receive work of this section during application and minimum 24 hours after application.

B. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where products will be applied for a time period before during and after application as recommended by manufacturer.

1. Do not apply Fluid Applied Acrylic Thermal Break when temperature of substrate and/or surrounding ambient air temperature is below 45° F (7° C). Temporary protection and heat shall be maintained at this minimum temperature for 24 hours before, during and 24 hours after material application.
2. Steel substrate temperature shall be a minimum of 5° F (3° C) above the dew point of the surrounding air for a period of 24 hours prior, during the application of the material and 24 hour cure period.
3. If necessary for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.

4. The relative humidity of the application area shall not exceed a maximum of 85% 24 hours prior, during and 24 hours after the application of the material. The relative humidity shall not exceed 75% throughout the application and curing of the decorative top coat finish.

PART 2 - PRODUCTS

2.0 FLUID-APPLIED INSULATIVE COATING GENERAL

A. Materials Compatibility:

1. Provide shop and field primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
2. Provide products of same manufacturer for each coat in a coating system.

2.1 MANUFACTURERS

A. Products specified are manufactured by Tnemec Company Inc., 123 West 23rd Avenue, North Kansas City, Missouri 64116, 816-483-3400, www.tnemec.com, ist@tnemec.com, and are specified as a standard of quality.

B. Materials specified herein shall not preclude consideration of equivalent or superior materials. Suggested equivalent materials or other substitutions shall be submitted to ARCHITECT for consideration in compliance with substitution procedures in Section 01 25 00 of this Project Manual and include the following:

1. Submittals shall be provided no later than (10) days after Owner letter of Notice to Proceed.
2. Requests for substitution shall include evidence of satisfactory past performance in similar environment.
3. Substitutions will not be considered that change the number of coats or do not meet specified dry film thicknesses.
4. Manufacturer's certified test reports showing the substitute product(s) performance as outlined in Paragraph 2.15 shall be submitted.
5. After second submittal, Architect/Owner hourly rates will be charged to review further submittals.

C. Bidders desiring to use coatings other than those specified shall submit those with their proposal based on the specified materials, together with the information required in Paragraph 1.5 above, and indicate the sum which will be added to or deducted from the base bid should alternate materials be accepted.

2.2 FLUID-APPLIED INSULATIVE COATING SYSTEM

A. PRIME COAT

1. Water-Based Cementitious Epoxy:

a. Tnemec Series 1224 Epoxoline WB

1) VOC Content: 1 gram/liter

2) Color: 1288 Off-White
3) Requirements:

a) Abrasion (ASTM D4060): No more than 149 mg loss after 1,000 cycles.
b) Adhesion to Steel (ASTM D4541): No less than 1,989 psi after 10 freeze/thaw cycles.
c) Humidity Resistance (ASTM D4585): No blistering, cracking, rusting, or delamination after 2,000 hours.
d) CDPH Compliant: Passes the California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1-2010 (also known as Section 01350).

B. **INTERMEDIATE COAT**

1. Fluid-Applied Acrylic Insulative Coating

a. Tnemec Series 971 Aerolon Acrylic

1) VOC Content: 1.9 grams/liter
2) Solids by Volume: 76 percent.
3) Colors: 1278 Insulation Yellow
4) Requirements:

a) Abrasion (ASTM D4060): No more than 50.2 mg loss after 1,000 cycles.
b) Cyclic Salt Fog/UV Exposure (ASTM D5894): No blistering, cracking, rusting or delamination of film after 5,000 hours.
c) Humidity Resistance (ASTM D4585): No blistering, cracking, rusting, or delamination after 2,000 hours.
d) Immersion (ASTM D870): No blistering, cracking, rusting, or delamination after six months continuous tap water immersion.
e) Surface Burning Characteristics (ASTM E84): Class A
f) Thermal Conductivity (ASTM C518): No greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft^2-hr-°F.
g) NORSOK M-501 ISO 20340: Passed 25 cycles.
h) CDPH Compliant: Passes the California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1-2010 (also known as Section 01350).

C. **FINISH COAT**

1. Waterbased, High Dispersion Pure Acrylic Polymer

a. Tnemec Series 1028 (gloss) or 1029 (Semi Gloss) Enduratone

1) VOC Content: 94 grams/liter.
2) Colors: As selected by Architect.
3) Requirements:

a) Adhesion (ASTM D4541): No less than 2,363 psi.
b) Abrasion (ASTM D4060): No more than 102 mg loss after 1,000 cycles.

c) Impact (ASTM D2794): No visible cracking or delamination of film after 93 inch-pounds or less direct impact.
d) QUV (ASTM D4587): No blistering, cracking or delamination of film. No less than 72% gloss retention, no more than 0.69 DE00 color change and no more than 22 units gloss loss after 3,000 hours.
e) Salt Spray (Fog) (ASTM B117): No blistering, cracking, rusting or delamination of film. No more than 3/16" (5 mm) rust creepage at scribe after 5,000 hours exposure.
f) CDPH Compliant: Passes the California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1-2010 (also known as Section 01350).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. All surfaces to receive the specified Tnemec Series 971 Aerolon shall follow the manufacturer's printed instructions and be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other foreign substances which would impair bond of the material to the substrate.

D. Other corrections of the surfaces to receive the Fluid Applied Insulation Coating material shall be the responsibility of the Contractor, at no additional cost to the Owner.

E. Application of the primer, Series 971 Aerolon, and topcoat shall not commence until the contractor, applicator and inspector have examined the surfaces to receive the primer and determined the surfaces are acceptable to receive the primer and Aerolon®. Commencement of application means acceptance of substrate.

F. Verify that substrate and workspace temperature and humidity conditions are in accordance with manufacturers recommendations.

3.2 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be coated with thermal break coating.

C. Weld spatter and defects shall be ground smooth prior to commencement of primer and fluid applied thermal break material.

D. Primer shall not be applied to prepared substrate until the area has been adequately vented to remove all airborne dust. Prior to the application of any coating material, the blast products, dust and debris shall be removed by vacuuming.

E. Steel Substrates: Remove rust and loose mill scale.

1. Fabrication defects:

a. Correct steel and fabrication defects revealed by surface preparation.
b. Remove weld spatter and slag.
c. Round sharp edges and corners of welds to a smooth contour.
d. Smooth weld undercuts and recesses.
e. Grind down porous welds to pinhole-free metal.
f. Remove weld flux from surface.

2. Ensure surfaces are dry.
3. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3, unless otherwise specified.

F. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

1. Shop Primer: Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

G. Concrete Surfaces (where thermal break is needed):

1. Grind all surfaces to receive primer.
2. Apply Series 1224 Epoxoline WB.

3.3 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

1. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
2. Keep containers closed when not in use to avoid contamination.
3. Do not use mixed coatings beyond pot life limits.
4. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

B. Uniformly apply coatings at spreading rate required to achieve specified DFT.

C. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

D. Apply primer at thickness recommended by manufacturer.

E. Apply Series 971 Aerolon Thermal Insulative Coating as specified in Section 3.8 Coating Schedule.

F. Apply topcoat at thickness recommended by the manufacturer.

G. Final Dry Film Thickness (DFT) shall be measured with a dry film thickness gauge.

H. The steel deck is not to be sprayed unless otherwise indicated.

3.4 REPAIR

A. Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: All patching and repair to material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by applicators certified by the manufacturer and applied in accordance with the manufacturer application instructions.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.5 FIELD QUALITY CONTROL

A. The Owner will engage an independent testing laboratory inspect and verify the application of material in accordance with the provisions Tnemec Company.

1. Material inspection and testing shall be performed 24 hours after completion of final application coat.
2. The results of the above tests shall be made available to all parties at the completion of each pre-designated area and approval.
3. In-place material not in compliance with the specified thickness requirements shall be corrected prior to final acceptance.

B. The dry film thickness (DFT) of the applied material shall be measured with a non-destructive coating thickness gage after material has completely cured. All measurements shall be documented in writing and furnished to the Owner.

C. Manufacturer's Technical Services: Coordinate with coating manufacturer's technical service department or independent sales representative for current technical data and instructions.

3.6 CLEANING AND PROTECTION

A. Remove overspray materials from surfaces not required to be thermally protected.

B. Protect surfaces of coating systems from damage during construction.

C. Touch-up, or repair damaged products before Substantial Completion.

3.7 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.

B. Inspection shall be attended by Owner, Contractor, Architect, and manufacturer's representative.

C. Repair deficiencies in coating systems as determined by Architect in accordance with manufacturer’s instructions.

3.8 FLUID-APPLIED INSULATIVE COATING SCHEDULE

A. Steel Members Penetrating Exterior Building Envelope/Inside Face of Metal Framing/Concrete Slab Edges/Aluminum Window Frames, Condensation Control:

1. Fluid-Applied Thermal Break System, Water-Based:

   a. Surface Preparation: SSPC-SP6/NACE 3
   b. Prime Coat (Shop or Field): Series 1224 Epoxoline WB, DFT of 4.0 to 10.0 mils (100 to 250 microns) per coat.
   c. Intermediate Coat (Shop or Field) – Two Coats: Series 971 Aerolon Acrylic, DFT of 40.0 to 50.0 mils (1000 to 1250 microns) per coat. Total thickness of Series 971: 80 to 100 mils (2000 to 2500 microns).
   d. Finish Coat (Optional): Series 1028 Enduratone, DFT of 2.0 to 3.0 mils (50 to 75 microns) per coat.

2. Fluid-Applied Thermal Break System, Zinc-Rich MCU Primer:

   a. Surface Preparation: SSPC-SP6/NACE 3
   b. Prime Coat (Shop or Field): Series 90-97 Tneme-Zinc, DFT of 2.5 to 3.5 mils (65 to 90 microns) per coat.
   c. Intermediate Coat (Shop or Field) – Two Coats: Series 971 Aerolon Acrylic, DFT of 40.0 to 50.0 mils (1000 to 1250 microns) per coat. Total thickness of Series 971: 80 to 100 mils (2000 to 2500 microns).
   d. Finish Coat (Optional): Series 1028 Enduratone, DFT of 2.0 to 3.0 mils (50 to 75 microns) per coat.

3. Fluid-Applied Thermal Break System, Mio-Zinc MCU Primer:

   a. Surface Preparation: SSPC-SP6/NACE 3
   b. Prime Coat (Shop or Field): Series 394-0250 PerimePrime, DFT of 2.5 to 3.5 mils (65 to 90 microns) per coat.
   c. Intermediate Coat (Shop or Field) – Two Coats: Series 971 Aerolon Acrylic, DFT of 40.0 to 50.0 mils (1000 to 1250 microns) per coat. Total thickness of Series 971: 80 to 100 mils (2000 to 2500 microns).
   d. Finish Coat (Optional): Series 1028 Enduratone, DFT of 2.0 to 3.0 mils (50 to 75 microns) per coat.

3.9 INSULATIVE BALCONY FLOOR SYSTEM COATING SCHEDULE

A. Insulative Balcony System:

1. Surface Preparation: Must be clean, dry and free of oil, grease, loosely adhered existing paint and all other contaminants. Prepare concrete by sanding, light grinding or by pressurized water cleaning between 4,000 and 5,000 psi using a "zero" degree oscillating tip (SSPC SP-12).
2. Prime Coat: Series 154 TnemeGuard, applied to the entire balcony, thinned 20-25%, DFT of 10.0 to 15.0 mils or 115 to 160 square feet per gallon.
3. Intermediate Coat (Shop or Field) – Two Coats: Series 971 Aerolon Acrylic (apply two feet out to top, sides, and bottom of balcony), DFT of 40.0 to 50.0 mils (1000 to 1250 microns) per coat. Total thickness of Series 971: 80 to 100 mils (2000 to 2500 microns).
4. Lay down a 30” wide strip of octagonal mat (S211-OC30375-UT Octagonal Mesh) over the Series 971 overlapping 6” onto the balcony.

5. Dip and roll Series 154 thinning up to 5% to saturate the mat (Broadcast to complete refusal).
6. Grout Coat: Series 154 TnemeGuard at 100-120 square feet per gallon.
7. Topcoat: Series 248 EverThane or Series 297 Enviro-Glaze, DFT of 2.0 to 3.30 mils.

END OF SECTION 07 21 63

SECTION 07 27 26 - FLUID APPLIED AIR BARRIER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Fluid-applied air barrier membrane in exterior wall assemblies.

B. Materials to bridge and seal the following air leakage pathways and gaps:
1. Connections of the walls to the roof air barrier.
2. Connections of the walls to the foundation air barrier.
3. Seismic and expansion joints.
4. Openings and penetrations of window frames, storefront, curtain wall and mechanical, electrical and plumbing systems.
5. Barrier precast concrete and other envelope systems.
6. Door frames.
7. Piping, conduit, duct and similar penetrations.
8. Masonry ties, screws, bolts and similar penetrations.
9. All other air leakage pathways in the building envelope.

C. Related Work in other Sections includes but is not limited to the following:
1. Section 01 45 00 – Quality Control
2. Section 01 50 00 – Temporary Facilities and Controls
3. Section 03 30 00 – Cast-In-Place Concrete
4. Section 04 20 00 – Unit Masonry
5. Section 07 41 13 – Prefinished Metal Roofing
6. Section 07 52 19 – Modified Bitumen “Cool Roof” Membrane Roofing System
7. Section 07 65 00 – Flexible Flashing
8. Section 07 90 00 – Joint Sealants
9. Section 09 21 16 – Gypsum Wallboard Systems (Exterior Sheathing)

1.3 PERFORMANCE REQUIREMENTS

A. Material Performance: Provide air barrier materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm / ft2 @ 1.57 psf), when tested in accordance with ASTM E2178 (unmodified).

B. Provide materials with a water vapor permeance of 10.0 US perms or greater, determined in accordance with ASTM E96 Water method (Procedure B).

C. Assembly Performance: Provide a continuous air barrier in the form of an assembly that has an air leakage not to exceed 0.04 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.04 cfm/ft2 @ 1.57 psf) when tested in accordance with ASTM E2357. The assembly shall accommodate movements of building materials by providing expansion and control joints as required. Expansion / control joints, changes in substrate and perimeter conditions shall have appropriate accessory materials at such locations.

1. The air barrier assembly shall be capable of withstanding combined design wind, fan and stack pressures, both positive and negative on the envelope without damage or displacement, and shall transfer the load to the structure.
2. Fluid applied air barriers shall not displace adjacent materials in the air barrier assembly under full load.
3. The air barrier assembly shall be joined in an airtight and flexible manner to the air barrier materials of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations, creep, and anticipated seismic movement.

D. Connections to Adjacent Materials: Provide connections to prevent air leakage at the following locations:

1. Foundation and walls, including penetrations, ties and anchors.
2. Walls, windows, curtain walls, storefronts, louvers or doors.
3. Different wall assemblies, and fixed openings within those assemblies.
4. Wall and roof connections.
5. Floors over unconditioned space.
6. Walls, floor and roof across construction, control and expansion joints.
7. Walls, floors and roof to utility, pipe and duct penetrations.
8. Seismic and expansion joints.
9. All other potential air leakage pathways in the building envelope.

1.4 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 – Project Coordination

1.5 SUBMITTALS

A. Submittals: Submit in accordance with Division 1 requirements.

B. Installer Qualifications: Submit evidence of current Contractor accreditation and Installer certification under the Air Barrier Association of America’s (ABAA). Submit accreditation number of the Contractor and certification number(s) of the ABAA Certified Installer(s).

C. Product Data: Submit material Manufacturer’s Product Data, material Manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, Technical Data, and tested physical and performance properties.

1. Submit letter from primary air barrier material Manufacturer indicating approval of materials that are proposed to be used that are not currently listed in the accessories section of this specification for that Manufacturer’s material.
2. Include statement from the primary air barrier material Manufacturer that the materials used in their air barrier assembly which will be used to adhere to the underlying substrate are chemically compatible to the substrate material.

D. Samples: Submit clearly labeled samples, three (3) inch by four (4) inch minimum size of each material specified.

E. Field Test Results of Mock-Up: Submit test results of air leakage test and water leakage test of mock-up in accordance with specified standards, including retesting if initial results are not satisfactory.

F. Compatibility: Submit letter from primary material Manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.

1.6 QUALITY ASSURANCE

A. Air Barrier Installer Qualifications: Air barrier Subcontractor(s) shall be accredited at the time of bidding and during the complete installation period by the Air Barrier Association of America (ABAA).

1. Fluid-applied membrane air barrier Installer(s) shall be certified in accordance with the requirements outlined by ABAA. Installers shall have their photo identification air barrier certification cards in their possession and available on the project site, for inspection upon request.

B. Manufacturer: Obtain primary ABAA Evaluated Materials from a single ABAA Evaluated Manufacturer regularly engaged in manufacturing specified fluid-applied membranes. Obtain secondary materials from a source acceptable to the primary materials Manufacturer.

C. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).

D. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

E. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction of mock-up, sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction and chemical/fire safety plans. Attendance is required by the Fluid Applied Air Barrier System Manufacturer’s field representative, representatives of related trades including covering materials, substrate materials and adjacent materials.

F. Mock-Ups: Build mock-up representative of primary air barrier assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Architect. Mock-up shall be dimensioned no less than eight (8) feet long by eight (8) feet high and include the air barrier materials and air barrier accessories proposed for use in the exterior wall assembly. The mock-ups shall remain visible and intact for the duration of the fluid applied air barrier system work scopes.

G. Mock-Up Tests for Air and Water Infiltration: The General Contractor shall provide testing of the window and door opening(s) in the mock-up for air and water infiltration. The testing shall be in accordance with AAMA 501.2 (hand wand field testing), If deficiencies are found, the air barrier Contractor shall reconstruct mock-up at their cost for retesting until satisfactory results are obtained. Deficiencies include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.

H. Air Barrier Assembly Testing: Verify air barrier assembly testing by the material Manufacturer by visiting the ABAA website to ensure an ASTM E2357 test has been completed and to obtain results. Visit the ABAA website for the reported air barrier assembly leakage rate and illustrations or CAD details which includes the methods in which the assembly test mock-ups shall be assembled.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with material Manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material Manufacturer. Protect stored materials from direct sunlight and other sources of ultra-violet light.

C. Handle materials in accordance with Manufacturer's recommendations.

1.8 PROJECT CONDITIONS

A. Temperature: Install fluid-applied air barrier material within range of ambient and substrate temperatures recommended by material Manufacturer. Do not apply air barrier to a damp or wet substrate.

B. Field Conditions: Do not install air barrier in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the Manufacturer.

C. Sequencing: Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

D. Compatibility: Do not allow air barrier materials to come in contact with chemically incompatible materials.

E. Ultra-violet exposure: Do not expose air barrier materials to sunlight longer than as recommended by the material Manufacturer.

1.9 WARRANTY

A. Material Warranty: Provide Manufacturer's standard product warranty, for a minimum 20 years from date of Substantial Completion.

B. Subcontractor (approved by ABAA and Manufacturer) Installation Warranty: Provide a five (5) year installation warranty from date of Substantial Completion, including all accessories and materials of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fluid Applied Membrane Air Barrier: Use regular, high temperature or low-temperature formulation depending on site conditions, within temperature ranges specified by Manufacturer. Subject to compliance with requirements, provide one of the following:

1. Carlisle Coatings and Waterproofing: Fire-Resist Barritech VP at 60 mils thick (wet). www.carlisle-ccw.com:

a. AIR BARRIER MATERIAL PROPERTIES:

1) Air permeance for this material has been tested and reported as being 0.0002 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0002 cfm/ft^2 @ 1.57 psf), at 65 mils (wet), when tested in accordance with ASTM E2178 (unmodified).
2) Water vapor permeance for this material has been tested and reported as being 817 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (817 ng/(Pa·s·m^2) / 14.295

US perms) at 60 mils (wet) [40 mils (dry)] when tested in accordance with ASTM E96 (water method – unmodified).

b. AIR BARRIER ACCESSORY MATERIALS:

1) Detail Flashing: Fire-Resist 705 FR.
2) Counter-flashing for Metal Wall Flashings: Fire-Resist 705 FR.
3) Water-Based Primer for Detail Flashing: CCW-702 WB.
4) Solvent-Based Primer for Detail Flashing: CCW-702 or CCW-702 LV.
5) Solvent-Based Aerosol Primer for Detail Flashing: CAV-GRIP.
6) Reinforcing Fabric: DCH Reinforcing Fabric.
7) Glass Mat: LiquiFiber-W.
8) Termination Mastic: SURE-SEAL Lap Sealant.
9) Fill Compound: CCW-201 or CCW-703 V.
1)

2. Grace Construction Products: Perm-A-Barrier VP, 90 mils thick (wet), 45 mils thick (dry). www.na.graceconstruction.com:

a. AIR BARRIER MATERIAL PROPERTIES:

1) Air permeance for this material has been tested and reported as being 0.0004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0004 cfm/ft^2 @ 1.57 psf), at 69 mils (wet), when tested in accordance with ASTM E2178 (unmodified).
2) Water vapor permeance for this material has been tested and reported as being 741.6 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (741.6 ng/(Pa·s·m^2) / 12.9 US perms) at 40 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).

b. AIR BARRIER ACCESSORY MATERIALS:

1) Membrane for details and Terminations: Bituthene Liquid Membrane.
2) Water-Based Primer for Flashing, Transition Strip and Detail Membrane: Perm-A-Barrier WB Primer or Perm-A-Barrier Primer Plus.
3) Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: Bituthene Primer B-2 and Bituthene Primer B2 LVC or Bituthene Primer B2.
4) Through-Wall Flashings or Shelf Angle Flashings: Perm-A-Barrier Wall Flashing below the flexible through wall flashing system.
5) Sealants, Mastics, Adhesives and Tapes: As recommended by Grace Construction Products.
6) Transition Membrane: Perm-A-Barrier Detail Membrane, Perm-A-Barrier Aluminum Flashing and Perm-A-Barrier Wall Flashing.
7) Penetrations and Termination Sealant: Bituthene Liquid Membrane and as recommended by Grace Construction Products.
8) Window Flashing and Detail Membrane: Perm-A-Barrier Detail Membrane, Perm-A-Barrier Aluminum Flashing and Perm-A-Barrier Wall Flashing.
9) Joint Sealant: Refer to Technical Letter 1 for details on compatible waterproofing sealants.

3. Henry Company: Air Bloc 17MR at 48 mils (wet) - *Medium build option*. www.henry.com:

a. AIR BARRIER MATERIAL PROPERTIES:

1) Air permeance for this material has been tested and reported as being 0.00024 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0001 cfm/ft^2 @ 1.57 psf), at 48 mils (wet) when tested in accordance with ASTM E2178 (unmodified).
2) Water vapor permeance for this material has been tested and reported as being 28 US perms at 25 mils (dry) when tested in accordance with ASTM E96 (water method – unmodified).

b. AIR BARRIER ACCESSORY MATERIALS:

1) Liquid Applied Flashing: Air-Bloc LF.
2) Transition Membrane: Blueskin SA and Blueskin SALT for low-temperature applications.
3) Sheathing Joint Membrane: Blueskin VP160.
4) Spray Adhesive: Blueskin Adhesive and Blueskin LVC Adhesive.
5) Water-Based Primer for Transition Membrane: Aquatac Primer.
6) Counterflashing for Metal Panel Through-Wall Flashing: Blueskin TWF.
7) Sealant: HE 925 BES Sealant.
8) Reinforcing Tape: HE 183 Yellow Glass Fabric.
9) Insulation Adhesive: Air-Bloc 21.

4. Tremco, Inc.: ExoAir 230 at 40 mils (wet) www.tremcosealants.com

a. AIR BARRIER MATERIAL PROPERTIES:

1) Air permeance for this material has been tested and reported as being 0.0003 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.0003 cfm/ft^2 @ 1.57 psf), at 40 mils (wet) when tested in accordance with ASTM E2178 (unmodified).
2) Water vapor permeance for this material has been tested and reported as being 1677 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (1677 ng/(Pa·s·m^2) at 29 mils (dry) when tested in accordance with ASTM E 96 (water method – unmodified).

b. AIR BARRIER ACCESSORY MATERIALS:

1) Solvent Based Primer: ExoAir Primer
2) Termination Mastic: ExoAir Termiantion Mastic
3) Sealants: Tremflex 834, Dymonic 100, Spectrem 1
4) Transition Membrane for Details and Terminations: ExoAir 110, ExoAir 111, ExoAir TWF, Dymonic 100
5) Reinforcing / Joint Tape: Tremco 2011 mesh
6) Flashing at Transition Membrane: ExoAir 111, ExoAir TWF, Dymonic 100
7) Counterflashing for Through Wall Flashings: ExoAir TWF
8) Through Wall Flashings or Shelf Angle Flashings: ExoAir TWF below the flexible through wall flashing system.
9) Solvent Based Primer for Flashing, Transition Strip and Detail Membrane: ExoAir Primer
10) Substrate Joint Treatment: Tremflex 834, Dymonic 100 depending on substrate.

5. W.R. Meadows, Inc.: Air-Shield LMP, at 60 mils (wet), 30 mils (dry). www.wrmeadows.com:

a. AIR BARRIER MATERIAL PROPERTIES:

1) Air permeance for this material has been tested and reported as being 0.000096 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.000096 cfm/ft2 @ 1.57 psf), [0.00048 liters per square meter per second under a pressure differential of 75 Pa (0.00048 L/(s·m2) @ 75 Pa)] at 20 mils (dry) when tested in accordance with ASTM E2178 (unmodified).
2) Water vapor permeance for this material has been tested and reported as being 598 nanograms of water vapor passing through each square meter of area per second for each Pascal of vapor pressure differential (598 ng/(Pa·s·m^2) [10.47 US perms] at 30 mils (dry) when tested in accordance with ASTM E 96 (water method – unmodified).

b. AIR BARRIER ACCESSORY MATERIALS:

1) Water-Based Primer: None required for Air Shield LMP.
2) Solvent-Based Primer: None required for Air Shield LMP.
3) Solvent-Based Aerosol Primer: None required for Air Shield LMP.
4) Termination Mastic: Pointing Mastic or BEM.
5) Transition Membrane for details and terminations: Air Shield.
6) Reinforcing / Joint Tape: Reinforcing Fabric HCR.
7) Flashing at Transition Membrane: Air Shield Thru-Wall Flashing.
8) Counter-flashing for Through-Wall Flashings: Air Shield Thru-Wall Flashing.
9) Through-Wall Flashings or Shelf Angle Flashings: Air Shield Thru-Wall Flashing below the flexible through wall flashing system.
10) Solvent-Based Primer for Flashing, Transition Strip and Detail Membrane: Mel-Prime VOC.
11) Water-Based Primer for Flashing, Transition Strip and Detail Membrane: Mel-Prime WB.
12) Substrate Joint Treatment: Air Shield Joint Filler.

2.2 AUXILIARY MATERIALS

A. Transition Membrane Between Air and Vapor Barrier Membrane and Roofing and Other Adjacent Materials: Comply with both air barrier Manufacturer's recommendations and roofing material Manufacturer's recommendations.

B. Provide primers, glass fabric scrim tape, mastic, and other materials not specifically described, but required for a complete and proper installation as instructed by the air barrier system Manufacturer or required to provide a continuous the air barrier assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The ABAA Certified Air Barrier Contractor shall examine substrates, areas, and conditions under which the air barrier assembly will be installed, with ABAA Certified Installer present, for compliance with requirements.

1. Confirm site access logistics and scheduling requirements, including but not limited to use of scaffolding, lifts and staging.
2. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
3. Ensure that the following conditions are met:
   a. Surfaces are sound, dry, even, and excess mortar and / or other contaminants.
   b. Inspect and confirm substrates to be smooth and without large voids or sharp protrusions. Inform General Contractor if substrates are not acceptable and need to be repaired by the substrate Subcontractor.

c. Inspect and confirm masonry joints to be reasonably flush and completely filled, and ensure all excess mortar accumulated on masonry ties has been removed. Inform General Contractor if masonry joints are not acceptable and need to be repaired by the masonry Subcontractor.
d. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.

4. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test.
5. Verify sealants are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
6. Notify Architect in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to material Manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

1. Ensure that penetrating work by other trades is in place and complete.
2. Prepare surfaces by brushing, scrubbing, scraping, grinding or compressed air to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the fluid-applied membrane.
3. Wipe down metal surfaces to remove release agents or other non-compatible coatings using clean sponges or with a material chemically compatible with the primary air material.

B. Prime substrate for installation of sheet membrane transition strips as recommended by material Manufacturer and as follows:

1. Prime masonry, concrete substrates with conditioning primers.
2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
3. Prime wood, metal, and painted substrates with primer.
4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier at protrusions.

C. Prime substrate for installation of fluid-applied air barrier if recommended by material Manufacturer based on project conditions.

D. Protection from spray-applied materials as recommended by material Manufacturer and as follows:

1. Mask and cover adjacent areas to protect from over-spray.
2. Ensure any required foam stop or back up materials are in place to prevent over-spray and achieve complete seal.

3.3 INSTALLATION

A. Fluid Applied Membrane Air Barrier: Install air barrier accessories and fluid-applied membrane air barrier material to provide continuity throughout the building envelope in a shingle fashion. Install materials in accordance with material Manufacturer's instructions and the following (unless Manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials):

1. Install veneer anchors as per air barrier Manufacturer installation sequencing.

2. Apply treatment to exterior gypsum joints and screw heads as per air barrier material Manufacturer.
3. Apply primer for transition material at the rate instructed by the air barrier material Manufacturer for 1 inch beyond terminating edge of transition membrane. Allow primer to set / cure completely before transition strip application.
4. Position subsequent sheets of transition material so that membrane overlaps the membrane sheet below by a minimum of 2 inches, unless greater overlap is recommended by the material Manufacturer. Ensure transition membrane is securely sealed onto substrate with roller.
5. Overlap horizontally adjacent pieces of transition material a minimum of 2 inches, unless greater overlap is recommended by the material Manufacturer. Roll all areas of transition strip including seams with roller.
6. Seal around all penetrations with termination mastic / sealant, membrane counterflashing or other procedure in accordance with material Manufacturer's instructions, ensuring chemical compatibility amongst adjoining materials.
7. Connect air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors, other intersection conditions and transitions from wet cavity to dry cavity and seal penetrations using accessory materials in accordance with the material Manufacturer's instructions.
8. Provide transition material at changes in substrate plane (with bead of sealant / mastic, membrane counter-flashing or other material recommended by material Manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
9. Provide mechanically fastened non-corrosive metal sheet or other Manufacturer approved transition material to span gaps greater than 1 inch in substrate plane and to make a smooth transition from one plane to the other. Transition membrane shall be installed continuously from air barrier material onto sheet metal maintaining 2 inch overlap on both edges.
10. Lap transition material over top edge of through-wall flashing and head-flashing.
11. Provide backup for the membrane to accommodate anticipated movement or use other Manufacturer approved transition material at deflection and control joints.
12. Provide transition material to joint assemblies at expansion and seismic joints.
13. Provide backup for the fluid applied air barrier to accommodate anticipated movement at deflection and control joints as recommended by material Manufacturer.
14. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and / or as otherwise recommended by the material Manufacturer.
15. Seal top edge of the self-adhered membrane to substrate with termination mastic at end of each working day.
16. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by material Manufacturer.
17. Install primer for fluid-applied air barrier if instructed by material Manufacturer.
18. Install fluid-applied membrane using equipment and methods recommended by Manufacturer to achieve a dry film thickness as required by the material Manufacturer.
19. Do not allow materials to come in contact with chemically incompatible materials.
20. Do not expose membrane to sunlight / ultraviolet light longer than as recommended by the Manufacturer.
21. Turn flashing membrane into window opening at sill, jambs and heads. Terminate just before interior sealant bead.

3.4 FIELD QUALITY CONTROL

A. Owner's Inspection and Testing: Cooperate with Owner's testing agency as applicable. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule for Work

of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted.

B. Manufacturer's Field Representative Review: Contractor is not to commence any work other than staging until contact and meeting with the Manufacturer's Field Representative on site. The Manufacturer's Field Representative is to visit the jobsite a minimum of four (4) times to review work processes and / or work completed prior to work commencement, at 10% completion, at 50% completion and prior to the work being covered by finish materials.

3.5 PROTECTING AND CLEANING

A. Protect air barrier materials from damage during installation and the remainder of the construction period, according to material Manufacturer's written instructions.

1. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the air barrier Manufacturer.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by Manufacturer of affected construction and acceptable to the primary material Manufacturer.

END OF SECTION

SECTION 07 41 13 - PREFINISHED METAL ROOFING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish all labor, materials, tools, equipment and services for all preformed roofing as indicated.

B. Coordinate with work of other trades.

C. It is the intent of this Section that the Work shall:
   1. conform to all applicable building code requirements and of authorities having jurisdiction;
   2. include, but not limited to:
      a. Preformed, prefinished metal roof panels;
      b. Roof insulation;
      c. Vapor barrier / underlayment;
      d. Substrate board, if shown or required by authorities having jurisdiction;
      e. Structural roof deck;
      f. Flashings;
      g. Gutters, downspouts and splash pans and splash blocks;
      h. Roof jacks;
      i. Roof curbs;
      j. All supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, weathertight, and complete installation.
   3. be performed by a single source contractor.

1.2 RELATED WORK

A. Division 5 Sections as required; generally: structural steel, steel joists, and miscellaneous metals.

B. Section 06 10 00 - Rough Carpentry

C. Section 07 62 00 – Roof Related Sheet Metal

D. Divisions 22, 23 and 26: All Sections of Work relating to or affecting the roofing system, including mechanical, plumbing and electrical items penetrating roofing system.

1.3 REFERENCES

A. American Institute of Steel Construction (AISC)
   1. Manual of Steel Construction

B. American Iron and Steel Institute (AISI)
   1. Cold Formed Steel Design Manual

C. ASTM International (ASTM)
   1. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   2. A792, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

3. C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
4. E108, Standard Test Methods for Fire Tests of Roof Coverings
5. E1514, Standard Specification for Structural Standing Seam Steel Roof Panel Systems
6. E1592, Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
7. E1646, Standard Test Method for Rate of Water Penetration Through Exterior Metal Roof Panel Systems By Uniform Static Air Pressure Difference
8. E1680, Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems
9. E2140 - Standard Test method for water penetration of metal roof panel systems by static water pressure head

D. Underwriters' Laboratories (UL)
1. Tests for Uplift Resistance of Roof Assemblies
2. Tests for Impact Resistance of Roofing Materials

E. Factory Mutual Research Corporation (FM) (FMRC)
1. Class 1-90 Windstorm Rating
2. Class 1-SH (Test 4471) Hail Damage Rating

F. International Conference of Building Officials (ICBO)
1. ICBO Evaluation Services, Inc. Report No. ER-5409

G. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
1. Architectural Sheet Metal Manual

H. ASCE-7 Wind uplifts requirements for geographical area.

I. International Building Code

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
1. Manufacturer must have a minimum of three (3) years' experience manufacturing roof panels of the type specified for this Project. Panels specified in this Section shall be produced in a factory environment or by Manufacturer's certified and approved on-site roll forming equipment to assure the highest level of quality control. A letter certifying compliance should accompany the product material submittal.

B. Installer's Qualifications:
1. Installer of the system shall be an approved installer, certified and authorized by the Manufacturer as trained and qualified to install the Manufacturer's product. Provide a letter of certification from Manufacturer that installer has a minimum of three (3) year of metal roof panel installation experience preceding the date upon which work is to commence. **(Submit a copy with Proposal Form).**

C. Field Measurements: Prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units, where final dimensions cannot be established prior to fabrication.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Performance Testing:

1. All panels must be FM Class 1-90 Windstorm Rating tested. Roofing system shall be installed in accordance with ASCE-7-16 wind uplift requirements for geographical location and a 150 MPH 3-second gust wind speed zone, Exposure B with an importance factor of 1.15 based on IBC requirements. Wind-resistance loads as indicated by structural engineer.
2. Panel system shall have an FM Hail Damage Rating of Class 1-SH (Test 4471).
3. Panel system shall have a Class “A” Fire Rating in accordance with ASTM E108.
4. Metal roof system must be installed to resist the roof design pressures calculated in accordance with IBC or authorities having jurisdiction. Determine panel bending and clip-to-clip strength by testing in accordance with ASTM E1592. Capacity for gauge, span or loading other than those tested may be determined by interpolating test results by engineer supplying calculations.
5. Metal roof system must meet the air infiltration requirements of ASTM E283 when tested with a 6.24 PSF pressure differential with resulting air infiltration of 0.0071 cfm/sq. ft.
6. Metal roof system must meet the water penetration requirements of ASTM E331 when tested with a 12.00 PSF pressure differential with no uncontrollable water leakage when five (5) gallons per hour of water is sprayed per square foot of roof area.
7. ICBO Evaluation Services, Inc. Report No. ER-5409 is in compliance with UBC authorities having jurisdiction.

1.6 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Manufacturer's installation instructions.

B. Shop Drawings: Include layouts of panels, details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashing, closures and special details. Distinguish between factory and field assembly work.

C. Calculations:
1. All calculations shall be sealed by a professional engineer licensed in the State of Texas.
2. Engineering calculations defining cladding loads on all roof areas based on specified building codes, allowable clip loads and required number of fasteners to secure the panel clips to the designated substructure.
3. Uplift loads on clip fasteners with full recognition of prying forces and eccentric clip loading.
4. Calculate holding strength of fasteners in accordance with submitted test data provided by fastener Manufacturer based on length of embedment and properties of materials.

D. Samples:
1. Color charts or samples from Manufacturer’s full line of standard and custom Kynar 500® or Hylar 5000® finishes for Architect’s selection.
2. One (1) foot long sample of coated panel, including clips and fasteners.

E. Certifications:
1. Manufacturer's certification that fasteners, clips, backup plates, closures, roof panels and finishes meet specification requirements and wind uplift requirements.

2. Manufacturer's certification that Installer meets requirements to install roof system and is qualified to obtain required warranties and has been certified for 3-years prior to proposal due date
3. Letter of certification from Manufacturer that installer is in compliance and meets specified requirements.
4. Letter of certification from Manufacturer that panels have been produced in a factory environment or with certified / approved fixed-base roll forming and leveler equipment.
5. Certified test results by a recognized testing laboratory or Manufacturer's laboratory (witnessed by a professional engineer) in accordance with specified performance test methods for each panel system.
6. Manufacturer's certification that materials are in compliance with the specifications, including but not limited to finish and panel material.
7. Manufacturer's affidavit that materials used in Project contain no asbestos.

F. Testing Reports: Showing metal panels have been tested in accordance with specified performance testing requirements.

G. Warranty: Manufacturer's warranty as specified.

1.7 INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 – Project Coordination.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver metal roof system to job site properly packaged to provide protection against transportation damage.

B. Handling: Exercise extreme care in unloading, storing and erecting metal roof system to prevent bending, warping, twisting and surface damage.

C. Storage:
1. Store all materials and accessories above ground on well skidded platforms.
2. Store under waterproof covering.
3. Provide proper ventilation of metal roof system to prevent condensation build-up between each panel or trim / flashing component.

1.9 WARRANTY

A. Warrant the work specified herein against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials or workmanship. Warranty shall be a "Weather tightness" Warranty. Field Reports are required throughout Project and are to be supplied by a Manufacturer's Approved Technical Inspector. Manufacturer's personnel which are not Quality Control Technicians are not acceptable for inspection.
1. Roof Panels and Finish:
   a. Durability of the roof panels due to rupture, structural failure or perforation shall be warranted for a period of 20 years by the Manufacturer.
   b. The exterior color finish for painted roof panels shall be warranted by the Manufacturer for 20 years against chalking, blistering, peeling, cracking, flaking, checking and chipping.
2. Weathertightness:

a. The entire roof system including all roof panels, flashings, curbs, interior gutters, etc. shall be warranted by the Manufacturer against leaks for a period of 20 years.
b. The warranty shall be issued to the Owner by the Manufacturer at time of entire Project Substantial Completion.
c. The warranty shall guarantee the entire roof system and associated work against defective materials and workmanship of installation.
d. The roof system shall include roof insulation, flashing, metal work, labor, and material shall be guaranteed against failure of workmanship and materials. Repair of the system by the Manufacturer, including materials and labor, shall be done at no cost to the Owner for duration of warranty period.

3. Roofing Contractor: Jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Architect accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the Contractor, and subcontractors, to make good the requirements of the warranty. The warranty will be held jointly with the Bonding Company for the first two (2) years and the Manufacturer for the remaining three (3) years.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers listed who produce products equivalent to those specified are approved for use on the Project. Other Manufacturers must have a minimum of ten (10) years' experience manufacturing equivalent products to those specified and comply with requirements of Division 1 regarding substitutions to be considered.
1. AEP-Span; Dallas, TX; (214) 827-1740
2. Fabral; Grapevine, TX; (800) 477-9066
3. MBCI; Houston, TX; (281) 445-8555
4. Carlisle Syntec, Inc.; Carlisle, PA, 800-479-6832
5. Peterson Aluminum (PAC CLAD); Tyler, TX, (800) 441-8661
6. Berridge Manufacturing Co.; San Antonio, TX; (800) 669-0009
7. McElroy Metal; Bossier City, LA, (800) 950-6531
8. UNA-CLAD; Anoka, MN, (800) 426-7737

B. Specifications are based on "138T" architectural structural standing seam metal roof system manufactured by McElroy Metal.

C. Materials shall be manufactured, specified, or accepted in writing by Roofing Manufacturer issuing the warranty. Proposed materials shall ensure full system warranty from said Manufacturer.

D. Roof panels with lap type side joints or those requiring battens or other non-integral sealing means or exposed structural fasteners will not be acceptable.

E. Roof panels shall be roll formed in the Manufacturer's plant to control quality or by certified / calibrated / approved on-site roll-forming equipment only.

F. Substitute Manufacturers will be approved by written addendum to all bidders. Voluntary alternates will not be considered. Substitutions will not be permitted after the bid date of this project.

G. Roof panels proposed for substitution shall fully comply with specified requirements in

performance.

H. Roof panels shall have a 20 year foamable mastic sealant plant-installed sealant for quality control. No solid butyl sealant or extruded rubber will be accepted.

2.2 MATERIALS

A. Metal Roof Panels:
1. (T-Panel) Panel Profile / Dimensions: 1 3/8" high vertical legs shall be spaced at 16 inches on-center striated panel in continuous length with mechanically seamed sidelaps.
2. Gauge: Minimum 24 gauge (UL 90 rated)
3. Sheet Material: Prefinished Galvalume Sheet Steel - ASTM 792-AZ-50.
4. Texture: Striations.
5. Finish: Full strength Kynar 500 or Hylar 5000 Fluoropolymer coating, applied by the Manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with primer with a dry film thickness of 0.25 mil. Finish shall conform to tests for adhesion, flexibility, and longevity as specified by the Kynar 500 or Hylar 5000 finish supplier. Color shall be selected by Architect from Manufacturer's full range of standard and custom non-metallic colors. (20 year warranty)
6. Touch-up Paint: Paint burns, scars, welds, and damaged and rusted surfaces with cold galvanizing paint in accordance with ASTM A780. Acceptable Products include ZRC Cold Galvanizing Compound manufactured by ZRC Chemical Products, Quincy, MA; Galvax Zinc-rich Cold Galvanizing Coating manufactured by Alvin Products, Inc., Lawerence, MA; or paint complying with military specification MILP-21035A, Type I or II.
7. Strippable Film: Applied to the top side of the painted coil to protect the finish during fabrication, shipping and field handling. Remove strippable film prior to installation.
8. Roof Panel Intermittent Clip: 16 gauge galvanized steel, one-piece or two-piece, designed to allow roof panel thermal movement and not contact roof panel cap, as supplied by Metal Roof Panel Manufacturer, meeting wind uplift requirements and design criteria of this section.
9. Roof Panel Intermittent Clip Bearing Plate: If required, in gauge, size and finish as supplied by and approved by Metal Roof Panel Manufacturer for use in Metal Roof Panel Manufacturer's full assembly warranted systems.
10. Roof Panel Multi-Span Clip: As provided by Metal Roof Panel Manufacturer for full assembly warranted systems.
11. Clip Fasteners: Stainless steel or with corrosion-resistant coating with washers. Manufacturer's panel clips spaced according to Structural Engineer's calculations as instructed for wind uplift requirements. Screw placement and spacing for wind uplift rating requirements and design specification for application, in length necessary to penetrate substrate minimum ¾" as supplied by Metal Roof Panel Manufacturer.
12. Concealed supports, angles, plates, accessories and brackets: gauge and finish as recommended and furnished by Manufacturer.
13. Accessory Screw: Size and screw type as provided by Metal Panel Manufacturer for each use, with prefinished, high-domed "ZAC" Type hex washer head in color to match panels where exposed to view.
14. Rivets: Full stainless steel, including mandrel, in size to match application.
15. Weather Seal: Manufacturer's approved weather seal applied continuously along locking seam prior to seaming.
16. Panels must be furnished and installed in continuous lengths from ridge to eave with no overlaps.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: All self-tapping / self-drilling fasteners, bolts, nuts, self-locking rivets and other suitable fasteners shall be designed to withstand specified design loads.
   1. Use long life fasteners for all exposed fastener applications.
   2. Provide fasteners with a factory applied coating in a color to match metal roof system application.
   3. Provide neoprene washers under heads of exposed fasteners.
   4. Locate and space all exposed fasteners in a true vertical and horizontal alignment. Use proper torque settings to obtain controlled uniform compression for a positive seal without rupturing the neoprene washer.
   5. Fasteners used to attach metal “Z” purlins shall be size and type recommended by Manufacturer to achieve FM 1-90 requirements.

B. Accessories:
   1. General: Provide all components required in accordance with the metal roof system Manufacturer’s approved shop drawings for a complete metal roof system to include panels, panel clips, trim / flashing, fascias, ridge, closures, sealants, fillers, and other required items.
   2. Cover Board: Glass-Faced Gypsum Roof Board equal to UL rated Type X “DensDeck Prime Roof Board w/ Eonic Technology” as manufactured by Georgia-Pacific. Stock board sizes shall be 48" x 96" x ½” or as indicated on drawings for roof assembly. Provide as required by manufacturer recommendation for project roof system(s). Approved substitute, SECUROCK by USG.
   3. Polyisocyanurate Roof Insulation: (As Required) Shall comply with ASTM C1289 Type II Class 2, Grade 2 with inorganic coated glass facer on both sides, with a 20 psi minimum compressive strength. Thickness shall be a minimum total of 4.4” (or size specified on drawings) and divided in two staggered layers. Basis of specification shall be ENRGY 3 CGF as manufactured by Johns Manville.
      1. Acceptable substitute manufacturers include Atlas Roofing and Hunter Panels.
   4. Waterproofing Membrane: 40 mil thick SBS modified bituminous product of self-adhering type with non-stick surface conforming to Grace Ice and Water Shield HT, Soprema HT underlayment, Carlisle WIP 300 HT underlayment or Architect approved equal.
   5. Prefabricated Roof Curbs and Equipment Supports, Roof Jacks, and Rooftop Walkways: Shall be product of Manufacturer approved by the metal roof system Manufacturer and as specified below. Curbs shall be type recommended by roofing Manufacturer to warranty curb and roofing for 20 years.
   6. Closures: All outside closures shall be fabricated from Galvalume® sheet steel of the same gauge, finish and color as the panels. Galvanized base is unacceptable.
   7. Tape Seal: Pressure sensitive, 100 percent solids, polyisobutylene compound sealing tape with a release paper backing. Provide permanently elastic, non-sagging, non-toxic, non-staining tape seal approved by the metal roof system Manufacturer.
   8. Joint Sealant: One-part elastomeric polyurethane sealant approved by the metal roof system Manufacturer.
   9. Splash Pans and Splash Blocks: Shall be as specified in Section 07 62 00, Sheet Metal Flashing, Gutters, Downspouts and Trim.

2.4 PANEL FABRICATION

A. Material shall be in-line tension leveled prior to roll forming panel profile.

B. Roll form panels in continuous lengths, full length of detailed runs.

C. Standard panel length shall be 45 feet, unless approved by the metal roof system Manufacturer.

D. Fabricate trim / flashing and accessories to detailed profiles.

E. Fabricate trim / flashing from same material as panel.

2.5 PREFABRICATED ROOF CURBS AND EQUIPMENT SUPPORTS

A. General: Comply with loading and strength requirements as indicated where units support other work. Coordinate dimensions of curbs and supports with equipment supplier/manufacturer.

B. Fabricate curbs of structural quality 0.080 inch aluminum, factory baked finished after fabrication in coating compatible with and matching roof panel finish, with mitered and continuously welded corner joints. Provide integral base plates and water diverter crickets. Front base plate shall be a minimum of 18 inches from beginning of water diverter. Curbs shall be designed to install under metal roof system on the high side and over the metal roof system on the low side.

C. Curbs shall be of size and design shown on the drawings or required, with minimum height of eight (8) inches above finished metal roof system.

D. Curbs shall be constructed to match slope of roof and provide a level top surface for mounting equipment in a level horizontal position, unless shown otherwise.

E. Curb flanges shall be constructed to match configuration of roof panels.

F. Coordinate work with mechanical installer to ensure matching finish of curbs provided for roof mounted mechanical equipment.

2.6 PREFABRICATED ROOF JACKS

A. Pipe flashings shall be one piece EPDM (ethylene propylene diene monomer) molded rubber boot having a serviceable temperature range of minus 60 degrees F to 270 degrees F and shall be resistant to ozone and ultraviolet rays. Units shall have an aluminum flanged base ring.

B. Provide high temperature rated rubber roof jacks at hot stacks as applicable, including but not limited to boiler flues, heater vents, steam relief, or similar conditions. Rating minimum of 400 degrees F.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.

B. Verify that installation may be made in accordance with approved shop drawings and Manufacturer's instructions. This specifically includes verifying the secondary structurals and/or decking are installed to meet building code requirements. Coordinate with metal roof system Manufacturer to insure that reduced clip spacings at eave, rake, ridge and

corner areas are accommodated. Supply calculations, sealed by a professional engineer licensed in the State of Texas, showing required clip spacings.

C. Discrepancies:
1. Bring discrepancies to the attention of the Architect.
2. Do not proceed with installation until discrepancies have been resolved.

3.2 INSTALLATION OF METAL ROOFING OVER METAL DECK

A. Install metal deck to structure to meet ASCE-7 wind uplift requirements.

B. Install metal roof system so that it is weathertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction. Isolate dissimilar metal contact with proper taping and / or coatings.

C. Coordinate Work, with installation of other associated Work, to ensure quality application.

D. Coordinate Work with installation of associated metal flashings and building walls.

E. Coordinate Work to minimize foot traffic and construction activity on installed finished surfaces.

F. Install substrate boards, hat channels, purlins, or furring channels in accordance with Manufacturer’s recommendations.

G. Install insulation over metal deck in conformance with approved shop drawings and Manufacturer's instructions.

H. Install substrate board over insulation in conformance with approved shop drawings and Manufacturer's instructions.

I. Install waterproofing membrane barrier over substrate board in conformance with approved shop drawings and Manufacturer's instructions. Lap and tape seal all joints in accordance with Manufacturer’s instructions.

J. Install one layer of minimum 18” wide (each roof plane) underlayment / waterproofing membrane in valleys, eaves, rakes, hips and ridges prior to installation of the field underlayment / membrane.

K. Remove protective strippable plastic film covering from metal roof panels, trim, and related items in accordance with Manufacturer's instructions.

L. Install metal roof panels, trim, and related items in accordance with approved samples with approved shop drawings and Manufacturer's instructions.

M. Provide concealed anchors at all panel attachment locations.

N. Install panels plumb, level and straight with seams and ribs parallel, conforming to design as indicated.

O. Install roof jacks in accordance with approved shop drawings and Manufacturer's instructions. Install roof jacks in flat of the roof panel. Coordinate location so roof panel seams are not altered.

P. Install roof curbs in accordance with approved shop drawings and Manufacturer's instructions. Anchor curbs securely in place with provisions for thermal and structural

movement. Provide prefinished metal cover around all curbs to match color and finish of metal roof panels.

Q. Install gutters and downspouts in accordance with approved samples with approved shop drawings and Manufacturer's instructions. Gutter design for required gutter and downspout sizes shall be submitted prior to installation.

R. Install downspouts plumb and level, attached to columns or wall with straps located at top and bottom of downspout and maximum ten (10) feet on center.

S. Install splash pans and splash blocks under discharge port of downspouts. Install splash pan over a protection (walkway) pad for downspouts located at roof level.

T. Install gutter screen over installed gutter. Secure screen to spacer with self-tapping screw.

U. Provide expansion joints on ends of gutters spaced maximum 50 feet on center. Install snap-on cover over expansion joint.

3.3 CLEANING AND PROTECTION

A. Remove scraps and debris and leave work area clean.

B. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on prefinished metal by painting with a compatible paint in color to match undamaged finish.

C. Clean other work damaged or soiled by Work of this Section.

D. Protect finished work from damage.

3.4 INSPECTION

A. Architect and Contractor reserve the right to inspect the work during application. Upon completion of the work, if inspection discloses that roofing is not in accordance with this specification or has been damaged, Contractor agrees to furnish additional materials necessary to make repairs and place work in an acceptable condition at no additional expense to Owner.

END OF SECTION

SECTION 07 42 13 - METAL WALL PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: Requirements including but not limited to:
   1. Concealed fastener metal wall panels as part of the assembly.
   2. Modular metal wall panel system consisting of aluminum panels in a rainscreen application.
   3. Accessories necessary for a complete installation.

1.3 REFERENCE STANDARD

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Texas with experience in the design of metal composite wall panels as part of curtainwalls and aluminum storefront systems to design and coordinate the cladding assembly using performance requirements and design criteria indicated.

1.5 SYSTEM REQUIREMENTS

A. Modular Metal Panel System: Rainscreen design consisting of dry seal joinery designed, attachment system components, and associated necessary to minimize water penetration and induce air circulation in the space behind the panel system. Moisture weeping trim at panel base details allows water to drain out of the system.

1.6 SUBMITTALS

A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings: Provide shop drawings prepared by manufacturer or manufacturer’s authorized dealer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale 3-inch per foot of all required trim and extrusions needed for a complete installation.
   1. Include data indicating compliance with performance requirements.
   2. Indicate points of supporting structure that must coordinate with modular metal panel system installation.

C. Samples:
   1. One (1) ft long sample of each listed panel, including clips (if applicable) & fasteners. Indicate perforation pattern where applicable.
   2. Minimum 2” x 4” chip of specified finish.

D. Qualification Information: For Installer and Installer’s field supervisor.

E. Warranty: Manufacturer’s sample warranty as specified.

1.7 DELIVERY AND STORAGE

A. All panels shall be delivered with appropriate packaging to provide protection against transportation damage. Materials damaged in shipping or storage shall not be used.

B. Store all materials and accessories above ground on well-skidded platforms. Store under waterproof covering. Provide proper ventilation to panels to prevent condensation build-up between panels.

1.8 COORDINATION

A. Coordinate work with installation of associated metal flashings and manufactured roof panels.

B. General contractor shall coordinate with all subcontractors including masonry, waterproofing membrane, sheathing work, and framing to ensure walls are plumb and ready to accept fasteners and panel systems.

C. Pre-construction meeting required with owner and architect. Representatives from all associated trades shall attend to coordinate arrival, delivery, and installation of products and materials.

1.9 WARRANTY

A. Warrant the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials or workmanship.

B. Provide a manufacturer's thirty (30) year finish integrity warranty.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Uninsulated Metal Wall Panels:
      a. CENTRIA, a Nucor company: www.centria.com/#sle.
      b. Alucobond.
      c. Armstrong Ceilings.
      d. Laminators, Inc.
      e. IMETCO.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures

2.2 MATERIALS

A. Uninsulated Metal Wall anels:
   1. Concealed-Fastener Metal Wall Panels (MPU-1):
      a. Basis of Design: Blend, 40% Box Rib 1, 30% Box Rib 2, 30% Box Rib 3 as manufactured by Pac Clad.
      b. Panel Coverage: As indicated on Drawings.
      c. Panel Height: As indicated on Drawings.
      d. Finish: MCM.
      e. Color: Charcoal Gray 6140360.
      f. Location: Refer to Drawings.
   2. Aluminum Composite Wall Panel (MPU-2):
      a. Basis of Design: ALPOLIC.
      b. Material: Aluminum.
      c. Thickness: 4 mm.
      d. Finish: Mica MZG Gray.
   3. Concealed-Fastener Soffit Panel (SFT-1):
      a. Basis of Design:Box Series Linear as manufactured by Certainteed.
      b. Size: 96 inches by 6 inches.
      c. Finish: MCM
      d. Color: Decorated (Powder Coat), Wood Look - Light Pecan.
      e. Suspension: Concealed.
      f. Location: Refer to Drawings.

B. Accessories:

1. Zees: 16 gauge minimum thickness galvanized steel, 2 inch rise minimum, or as required to align with existing conditions.
    a. Thermally Broken Zee Strips as manufactured by Knight Wall systems for metal wall panels attached to the buidling or by the following approved manufacturers:
        1) Cladiators.
2. Sub-Girt Fasteners: Stainless Steel screws to meet application.
3. Concealed Fasteners: Stainless Steel screws supplied or recommended by panel manufacturer to suit application.
4. Metal Trim at Siding Panels: 0.060 inch thick pre-finished aluminum sheet, matching finish type and color of siding panels.
5. Closures: 0.060 inch thick aluminum sheet, mill finish.
6. Separate dissimilar metals with asphalt-saturated building felt or a bituminous coating to prevent galvanic action.

PART 3 EXECUTION

3.1 EXAMINATION OF MODULAR METAL PANEL SYSTEM

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
    1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
    2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
        a. Verify that air or water resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel as required by manufacturer's written recommendations.

3.3 METAL WALL AND SOFFIT PANEL INSTALLATION

A. Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the work securely in place, with provisions for thermal and structural movement.
    1. Shim or otherwise plumb substrates receiving metal composite material panels.
    2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self tapping screws. Do not begin installation until air or water resistive barriers and flashings that will be concealed by metal composite material panels are installed.
    3. Install screw fasteners in predrilled holes.
    4. Locate and space fastenings in uniform vertical and horizontal alignment.
    5. Install flashing and trim as metal composite material panel work proceeds.
    6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
    7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self tapping screws. Fasten flashings and trim around openings and similar elements with self tapping screws.

8. Provide weathertight escutcheons for pipe and conduit penetrating panels.

B. Fasteners:
   1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
   1. Include attachment to supports, panel to panel joinery, panel to dissimilar material joinery, and panel system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
   1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00.
   2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
   3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.

F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed and returned flanges of wall panels to panel clips with standard fasteners.
   1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 07 92 00 “Joint Sealants”.
   2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.

G. Subgirt and Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt and spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
   1. Install wall panels to allow individual panels to free float and be installed and removed without disturbing adjacent panels.
   2. Do not apply sealants to joints unless otherwise indicated.

H. Track Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
   1. Attach routed and returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
   2. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
   3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
   4. Do not apply sealants to joints unless otherwise indicated.

I. Rainscreen Principle Installation: Install using assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to

receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal composite material wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.

1. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
2. Do not apply sealants to joints unless otherwise indicated.

J. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; provide types recommended in writing by metal composite material panel manufacturer.

K. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA Architectural Sheet Metal Manual. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated, and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections.

B. Water Spray Test: After installation, test area of assembly directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer Field Service: Engage a factory authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.

D. Metal composite material wall panels are considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13

SECTION 07 52 19 - MODIFIED BITUMEN "COOL ROOF" MEMBRANE ROOFING SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. The installer shall coordinate the work of the entire roofing assembly, including, but not limited to:
   1. Tapered edge strips, cant strips, and wood nailers. (Refer to this Section and Section 06 10 00)
   2. Curbs, (Refer to Section 07 72 00)
   3. Modified bitumen membrane roofing
   4. Flashings, including sheet metal perimeter edge (fascia) (Refer this Section and Section 07 62 00)
   5. Walkway pads, expansion joints, and other work incidental to, the complete and proper installation of a watertight modified bitumen membrane roofing system as shown on the drawings or specified herein, and in accordance with all applicable requirements of the Contract Documents.

B. It is the intent of this Section that the Work shall:
   1. provide a watertight facility;
   2. conform to all applicable building code requirements and of authorities having jurisdiction;
   3. include Section 07 62 00, Sheet Metal Flashing, Downspouts, Gutters and Trim, and Section 07 72 00, Roof Accessories as part of the Work of this Section; and
   4. Provide Owner with a single source full system warranty as specified.

1.3 RELATED WORK

A. All Sections of Work relating to the roofing system, including mechanical, plumbing and electrical items penetrating the roof system.

1.4 REFERENCES

A. ASTM International (ASTM)
   1. C728, Standard Specification for Perlite Thermal Insulation Board
   2. C920, Standard Specification for Elastomeric Joint Sealants
   3. C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
   4. D41, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
   5. D312, Standard Specification for Asphalt Used in Roofing
   6. D4479, Standard Specification for Asphalt Roof Coatings - Asbestos-Free
   7. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free
   8. D4897, Standard Specification for Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
   9. D5147, Standard Specification for Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
   10. D6163, (D5147 & D146) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

B. ASCE-7 Wind uplifts requirements for geographical area.

C. Federal Specifications (FS)
   1. TT-S-00230C

D. National Roofing Installers Association (NRCA)
   1. Roofing and Waterproofing Manual - Latest Edition

F. Sheet Metal and Air Conditioning Installers National Association, Inc. (SMACNA)
   1. Architectural Sheet Metal Manual - Latest Edition

G. Underwriters' Laboratories (UL)
   1. Fire Hazard Classifications

H. International Building Code

1.5 SUBMITTALS

A. Product Data: Manufacturer's printed instructions, schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, fastener pattern layout, and accessories to be used in the Work.

B. Certifications:
   1. Manufacturer's written certification that installer is approved and licensed to install specified roofing system. **(Submit a copy with Proposal Form).**
   2. Manufacturer's affidavit that materials used in Project contain no asbestos.
   3. Installer shall submit resume and project experience list for proposed system for Project Manager and job site superintendent.
   4. Installer shall submit written certification that there are no undocumented workers being employed by them or by any subinstaller on this project and that all workers on this project are covered by workmen's compensation.
   5. Installer shall submit list of all subinstallers with evidence of subinstaller's insurance coverage in compliance with contract requirements.
   6. Manufacturer's written certification of approval / acceptance of these specifications and details.

C. Referenced Standards: Two (2) copies of each referenced standard and retain approved copies at site.

D. Project Registration "Pin" proving the project has been registered with Manufacturer.

E. Shop Drawings: Furnish from copies of the manufacturer's literature or from copies of NRCA "Roofing and Waterproofing Manual", Latest Edition.
   1. Furnish for approval any proposed details which differ from those included with this proposal package. All proposed details shall first be approved in writing by roofing manufacturers prior to submitting to Architect for approval.
   2. Furnish detail project sequencing, staging, material loading, manpower plans, and project construction schedule for approval.

F. Samples:
   1. Furnish copy of sample warranty that is to be issued upon project completion.

G. Temperature Charts: Bitumen heating devices 24 hour temperature charts.

H. Test Reports: Bitumen manufacturer's test reports relative to the following for each batch of bitumen furnished:
   1. Softening Point: ASTM D312.
   2. Flashpoint: ASTM D92.
   3. Acceptable Bitumen Temperature: As recommended by the bitumen manufacturer and EVT label on containers.
   4. Thermometers: Two (2) hand held, "8F" thermometers complying with ASTM E1 to Architect for his checking kettle temperature.

I. Upon Substantial Completion of Work, submit the following to Architect for his submission to Owner:
   1. Manufacturer's Warranty: Manufacturer's written warranty as specified.
   2. Maintenance Procedures: Three (3) copies of Manufacturer's printed instructions for Owner's use regarding care and maintenance of roof.

J. Certificate of Analysis: Provide manufacturer's printed certificate of analysis for all materials used. Attach copy with final warranty.

1.6 INSPECTIONS / TESTS

A. The Owner's, Architect's, and Manufacturer's representative shall at all times have access to the job site and work areas. The installer will provide proper and safe facilities for such access and inspection.
   1. Architect Inspections:
      a. The Architect will be providing periodic inspections throughout the duration of the project. Architect's Representative shall be required to inspect after completion of each major phase of construction for approval.
   2. Manufacturer Inspections:
      a. An inspection shall be made by a representative of the material manufacturer at appropriate intervals during performance of Work to ensure that said project is installed in accordance with the manufacturer's specifications and illustrated details. Written reports by the manufacturer shall be turned over to the Architect, on each Monday following the prior week.
      b. The authorized material Manufacturer's field representative shall be responsible for:
         1) Keeping the Architect's representative informed after periodic inspections as to the progress and quality of the work observed.
         2) Calling to the attention of the installer those matters observed which are considered to be in violation of the contract requirements.
         3) Reporting to the Architect's representative, in writing, any failure or refusal of the installer to correct unacceptable practices called to his attention.
         4) Confirming, after completion of the work and based on his observation and test, that he has observed no application procedures in conflict with these specifications. Final payment will not be released until the Architect has received all specified warranties.

B. Any failure by the Owner's, Architect's or Manufacturer's Representative to detect, pinpoint, or object to any defect or noncompliance of these specifications of work in progress or completed work shall not relieve the installer, or reduce, or in any way limit, his responsibility of full performance of work required of him under these specifications.

C. Architect may require tests and inspections as necessary to verify quality of roofing materials and workmanship. Laboratory tests will be performed in accordance with ASTM standard procedures.
   1. Owner will select testing laboratory and will pay for Work required by testing laboratory.
   2. Retests for work which fail initial tests or inspections shall be paid by installer.

1.7 QUALITY ASSURANCE

A. Installer:
   1. Installer shall have approval by manufacturer of accepted roofing system for application and issuance of specified warranty for a minimum of three (3) years. Proof of license agreement dated at least three years prior to date of bid opening.
   2. Installer shall be an experienced single firm specializing in the type of roofing and sheet metal work specified, with a minimum of five (5) years of previous successful experience on projects similar in size and scope.
   3. Installer shall be certified and approved by manufacturer and licensed to install specified roofing system.
   4. No subcontracting of sheet metal fabrication or installation will be accepted. Installer must have a sheet metal shop on the company premises.
   5. Installers shall have a competent Superintendent, who is not actually performing roofing work, on site at all time while work is in progress, with full authority to act on behalf of the Installer as his agent.
   6. All workmen shall be covered by Workmen's Compensation insurance (verify upon request) and thoroughly experienced in the particular class of work upon which employed. Use of undocumented workers will not be tolerated - No Exceptions.
   7. Installer shall ensure that base fastener pull out resistance tests on existing decks were performed and approved by Architect and coordinated with Roofing Consultant prior to starting roofing application.
   8. Roofing installer must have reached the highest level of qualifications from the Manufacturer they are providing material for (i.e. Master Select installer).

B. Regulatory Requirements:
   1. Classification by Underwriters' Laboratories, Inc. as a Class A roof covering.
   2. Roofing system shall be installed in accordance with ASCE-7-16 wind uplift requirements for geographical location exposure B, 150 MPH 3-second gust wind speed zone and risk category III based on IBC building code requirements. Wind-resistance loads listed below have a safety factor of 2.0 incorporated into the calculation.
      a. Zone 1' Field -38.8 psf or as otherwise indicated by Structural
      b. Zone 1 Field -67.4 psf or as otherwise indicated by Structural
      c. Zone 2 Perimeter -88.9 psf or as otherwise indicated by Structural
      d. Zone 3 Corner -121.2 psf or as otherwise indicated by Structural
   3. Follow local, state, and federal regulations of safety standards and codes. Refer to applicable building code or International Building Code for roofing system installation requirements and limitations.

C. Laboratory Testing and Samples:
   1. Architect may require tests and inspections as necessary to verify quality of roofing materials and workmanship. Laboratory tests will be performed in accordance with ASTM procedures.
   2. Owner will select testing laboratory and will pay for Work required by testing laboratory. Installer shall assume all costs for extraction and patch of all samples.

3. Re-tests for work which fail initial tests or installer shall pay inspections.
4. Installer shall correct all deficiencies in accordance with manufacturers recommended procedures at no cost to Owner.

D. Installation:
1. Unless otherwise indicated, the materials to be used in this specification are those specified and denote the type, quality, performance, etc. required. All proposals shall be based upon the use of the specified material.
2. Install materials in accordance with the manufacturer's current published application procedures and the general recommendations of the National Roofing Installer's Association.
3. It will be the installer's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the installer shall be responsible for the correctness of it. Any drawings supplied are for reference only.
4. Installer shall plan and conduct the operations of the work so that each section started on one day is complete, details installed and thoroughly protected and in watertight condition before the close of work for that day.
5. Materials will be securely fastened in place in a watertight, neat and workmanlike manner. All workmen shall be thoroughly experienced in the particular class of work upon which employed. Work shall be performed in accordance with these specifications and shall meet the approval in the field of the Architect.
6. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust, and shall be deposited at an approved disposal site. At completion, all work areas shall be left broom clean and all installers' equipment and materials removed from the site.

1.8 PERFORMANCE REQUIREMENTS

A. Fire Resistance: Meet Underwriter's Laboratory Class "A" fire rating.

B. Installer shall ensure that base fastener pull out resistance tests on new lightweight insulating concrete fill were performed and approved by Architect and coordinated with Roofing Consultant prior to starting roofing application.

1.9 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 – Project Coordination.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened packaging with all tags and labels intact and legible. Carton and can labels shall indicate appropriate warnings, storage conditions, lot numbers, and usage instructions. Handle and store materials and equipment in such a manner as to avoid damage. The proper storage of materials is the sole responsibility of the installer. Materials damaged in shipping or storage shall not be used. Wet or damaged roofing materials shall be discarded, removed from job site, and replaced with new materials prior to application.

B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be accepted minimum for exterior coverings. All stored materials, as mentioned above, shall be minimum of four (4) inches off the substrate and the tarpaulin tied off with rope.

C. Products liable to degrade as a result of being frozen shall be maintained above 40° F in heated storage.

D. Moisture sensitive products shall be maintained in dry storage areas or properly covered. Roofing insulation and felts must always be covered or stored in a dry area when not being used.

E. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

1.11 WARRANTY / GUARANTEE

A. Roofing Manufacturer: Warrant the roofing and associated Work for 20 years from date of Substantial Completion as follows:
   1. The warranty shall be a NDL “No Dollar Limit” / no penal sum type, with total replacement cost.
   2. The warranty shall guarantee the entire roof system and associated work against defective materials and workmanship of installation, with NO exclusion for ponding water.
   3. The roof system including roofing insulation, flashing, penetrations, wall flaashings, metal work, labor, and material shall be guaranteed against failure of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.
   4. Submit four (4) original executed copies of the Warranty / Guarantee.

B. Roofing Installer: Jointly with any subinstallers employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Architect accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the Installer, and subinstallers, to make good the requirements of the warranty. The warranty will be held jointly with the Bonding Company for the first two (2) years and the manufacturer for the remaining three (3) years.

C. Make arrangements with the materials manufacturer to provide the required warranty. Final warranty shall be submitted to Owner at time of Substantial Completion.

D. Submit attached Installer’s Warranty and Subinstaller’s Guarantee forms at Project Closeout.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS/MANUFACTURERS

A. Unless noted otherwise, specifications are based on products of named manufacturers but should not preclude the Installer from using other manufacturers who produce products that meet or exceed the specifications. Manufacturers whose products meet or exceed the specifications, who have manufactured and installed roof materials and systems of the type specified for a minimum of ten (10) years, and who maintains a single source responsibility for the total roofing system, as described herein, may apply for approval as a substitution in accordance with Division 1 requirements regarding substitutions.
   1. All materials shall be manufactured, specified, or accepted in writing by membrane manufacturer issuing the warranty. Proposed materials shall ensure full system warranty from said manufacturer. Installer shall be an installer licensed by the manufacturer.

2. Samples of all materials used on the project, which are not supplied by the membrane manufacturer, shall be submitted to the membrane manufacturer for written approval prior to starting work.
3. All materials used on the project shall be asbestos free.

B. Approved Manufactures:
1. Siplast, Inc., Irving, Texas; (972) 869-0070
2. Soprema, Wadsworth, OH; (800) 356-3521
3. Holcim Elevate, Carmel, IN; (800) 428-4442
4. Johns Manville, Denver, CO; (800) 654-3103

2.2 ROOFING SYSTEM ASSEMBLY/PRODUCTS

A. Modified Base Sheet: A fiberglass reinforced, Styrene-Butadiene-Styrene (SBS) modified asphalt coated sheet, having an average weight of 28 pounds per square.
1. Approved Product:
a. Siplast Product: Para Base, base sheet
b. Soprema Product: Sopra-G, base sheet
c. JM Product: Perma Ply 28, base sheet
d. Holcim Elevate Product: MB Base, base sheet

B. Dry Sheathing Paper: (For use as a slip sheet) Rosin coated, 5 lbs. per 100 sq. ft.

2.3 ROOF MEMBRANE ASSEMBLY

A. System Description: A roof membrane assembly consisting of two (2) plies of a prefabricated, reinforced, homogeneous polymer modified asphalt membrane, secured to specified insulation or substrate. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system. Installer option to install using hot asphalt “mopped”, cold adhesive, torched, or any combination – confirm special membrane types with manufacturer. Provide components of the roof membrane assembly meeting the following physical and mechanical requirements.

1. **Hot Asphalt Applied Modified Bitumen Base Ply:** Approximately 90 mil high performance modified bitumen base ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality modified bitumen and having the following properties:
a. Approved Product:
1) Siplast Product: Paradiene 20
2) Soprema Product: Elastophene Sanded 2.2
3) Holcim Elevate Product: SBS Base
4) JM Product: DynaBase

2. **Torch Applied Modified Bitumen Base Ply:** Approximately 120 mil high performance modified bitumen base ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality modified bitumen and having the following properties:
a. Approved Product:
1) Siplast Product: Paradiene 20 TG
2) Soprema Product: Elastophene Flam
3) Holcim Elevate Product: SBS Glass Torch Base
4) JM Product: DynaWeld Base

3. **Hot Asphalt Applied Modified Bitumen Finish Ply:** Approximately 130 mil or better high performance modified bitumen "cool roof" reflective white finish ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality Styrene-Butadiene-Styrene (SBS) modified bitumen, and having the following properties:
   a. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
   b. Surfacing: White ceramic chips
   c. Solar Reflectance (avg.): greater than 3 year aged .75
   d. Thermal Emnittance (avg.): greater than 3 year aged .75
   e. Solar Reflectance Index (avg.): greater than 3 year aged 64
   f. Approved Product:
   g. 1) Siplast Product: Paradiene 30 FR BW
   h. 2) Soprema Product: Elastophene LS FR GR SG
   i. 3) Holcim Elevate Product: SBS Glass FR Ultrawhite
   j. 4) JM Product: DynaGlas FR CR G

4. **Torch Applied Modified Bitumen Finish Ply:** Approximately 140 mil or better high performance modified bitumen "cool roof" reflective white finish ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality Styrene-Butadiene-Styrene (SBS) modified bitumen, and having the following properties:
   a. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
   b. Surfacing: White ceramic chips
   c. Solar Reflectance (avg.): greater than 3 year aged .75
   d. Thermal Emittance (avg.): greater than 3 year aged .75
   e. Solar Reflectance Index (avg.): greater than 3 year aged 64
   f. Approved Product:
      1) Siplast Product: Paradiene 30 FR TG BW
      2) Soprema Product: Elastophene Flam LS FR GR SG
      3) Holcim Elevate Product: SBS Glass FR Torch Ultrawhite
      4) JM Product: Dynaweld Cap FR CR

5. Stripping Ply: Same as roof system base ply.

2.4 FLASHING MEMBRANE ASSEMBLY

A. A flashing membrane assembly consisting of two (2) plies of reinforced, polymer modified asphalt membrane (foil face flashing membrane can be used as substitute):
   1. Modified Bitumen Flashing Sheet: Same as roof system finish ply.

   2. Modified Bitumen Foil Faced Flashing Sheet (Substitute):
      a. Siplast Product: "Aluminum" Veral
      b. Soprema Product: Sopralast 50 TV "Alu"
      c. Holcim Elevate Product: SBS Metal Flash AL
      d. JM Product: DynaClad AL

   3. Reinforcing Ply: Same as roof system base ply.

2.5 ROUGH CARPENTRY

A. All nailers, cants and wooden curbs shall be No. 2 or better treated lumber selected to meet design details and field dimensions and requirements of Section 06 10 00, Rough Carpentry. MCQ and MCA only.

2.6 ROOFING SHEET METAL

A. Refer to Section 07 62 00, Sheet Metal Flashing, Gutters, Downspouts and Trim.

2.7 ROOF INSULATION

A. Roofing Insulation:
1. All insulation shall be approved in writing by the membrane manufacturer as to thickness, type, and manufacturer. All insulation must be approved for the specific application with UL and FM Global approval. Refer to Div. 3 for insulation in lightweight concrete.
2. Polyisocyanurate Roof Insulation: (As Required) Shall comply with ASTM C1289 Type II Class 2, Grade 2 with inorganic coated glass facer on both sides, with a 20 psi minimum compressive strength. Thickness shall be a minimum total of 4.4” (or size specified on drawings) and divided in two staggered layers. Basis of specification shall be ENRGY 3 CGF as manufactured by Johns Manville.
   a. Acceptable substitute manufacturers include Atlas Roofing and Hunter Panels.
3. Cover Board: Glass-Faced Gypsum Roof Board equal to UL rated Type X “DensDeck Prime Roof Board w/ Eonic Technology” as manufactured by Georgia-Pacific. Stock board sizes shall be 48" x 96" x ½” or as indicated on drawings for roof assembly. Provide as required by manufacturer recommendation for project roof system(s). Approved substitute, SECUROCK by USG.
4. Substrate Board: Where required for fire rating or as indicated, 5/8 inch thick Gypsum Board, tapered-edged, conforming to ASTM C36, Type X. Sizes shall be 4 feet-0 inches wide by longest practical length to minimize joints.
5. Polyisocyanurate Tapered Roof Insulation: (As Required) Shall comply with ASTM C1289 Type II Class 2, Grade 2 with inorganic coated glass facer on both sides, with a 20 psi minimum compressive strength. Provide factory cut 48” x 48” stock board. Slope and thickness to vary as required to achieve a minimum ¼” per foot finished slope unless noted otherwise on the Drawings (cricketed areas between roof drains / scuppers are to achieve a minimum ½” per foot slope). Provide ½” cover board similar to that specified above tapered polyisocyanurate board insulation. Basis of specification shall be ENRGY 3 CGF as manufactured by Johns Manville.
   a. Acceptable substitute manufacturers include Atlas Roofing and Hunter Panels.
6. Tapered “Fesco” Edge Strip: 0” to 1½” tapered (or as required for field conditions), 18” wide x 48” long. Install at all expansion joints, curbs, projections, crickets, saddles and base flashings. Basis of specification shall be as manufactured by Johns Manville or approved substitute.

2.8 ROOFING ACCESSORIES

A. Roofing Adhesives:
1. Mopping Asphalt: Asphalt that has been certified for full compliance with the requirements for Low Fume Type IV asphalt listed in Table I, ASTM D312. Each container or bulk shipping ticket shall indicate the equiviscous temperature EVT, the finished blowing temperature, FBT, and the flash point, FP.

a. Approved Product: Trumbull Low Fume asphalt or as required by membrane.

2. Cold Adhesive (if applicable): An asphalt based adhesive formulated especially for adhering polymer modified asphalt roofing membranes and base plies. Adhere shall be UL & FM listed and approved.
   a. Soprema Product: FMA
   b. Siplast Product: PA-311 Adhesive
   c. Holcim Elevate Product: MB Cold Adhesive
   d. JM Product: MBR Cold Application Adhesive

B. Bituminous Cutback Materials:
1. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D41 requirements.
   a. Approved Product: PA-1125 Asphalt Primer manufactured by Siplast.
2. Mastics: An asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges and conforming to ASTM D4586 Type II requirements.
   a. Approved Product: PA-1021 Plastic Cement manufactured by Siplast.

C. Caulking and Sealants:
1. VOC Content: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Nonmembrane Roof Sealants: 300 g/L; single component, high performance, elastomeric sealants conforming to ASTM C920 requirements.
   b. Modified Bituminous Sealants: 500 g/L
   c. Other sealants: 420 g/L

D. Ceramic Granules: No. 11 Grade Specification Ceramic granules of color scheme matching the granule surfacing of the finish ply.

E. Metallic Dust: A finely graded metal dust as supplied or approved by the membrane manufacturer, used for covering of bitumen overruns over the foil surfaced membrane.

F. Fasteners:
1. Shall be Factory Mutual approved and as recommended by the manufacturer for the specific application.
2. Fastener for Brick: Shall be 1/4 inch x 2 inches, stainless steel nail, one piece unit, flat head, as manufactured by Rawl Zamac Nailin, or approved equal.
3. Fastener for Wood: Shall be a #14 Factory Mutual approved fastener, fluorocarbon coated, with CR-10 coating. A minimum 0.200 inch diameter shank and 0.250 inch diameter thread. To be used with Factory Mutual approved, round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to 30 Kesternich cycles (DIN 50018) shows less than ten percent (10%) red rust which surpasses Factory Mutual Approval Standard 4470 as manufactured by Olympic Manufacturing Group, Inc., or pre-approved equal.
4. Lightweight Insulating Concrete Base Sheet Fasteners: Shall be approved by the fastener manufacturer, membrane manufacturer and FM for use with lightweight insulating concrete as follows:
   a. Fastener shall be a single unit, precision formed, of electro zinc coated steel having a 2.7 inch diameter rib reinforced cap and 1.7 inch long rectangular legs, designed to expand when fully driven into the lightweight

insulating concrete. Fasteners for lightweight insulating concrete shall meet FM Standard 4470 requirements for corrosion resistance.
1) Approved Product: “Zono-tite” Base Sheet Fasteners.

5. Roofing Nails: Stainless steel, 316, type, size as required to suite application, minimum 11 gauge with 3/8 inch diameter head, minimum 1-1/2 inches in length.
6. Dual Prong Fastener: Coated Steel tube with stainless steel Locking Staple.

G. Walkway Pads: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface meeting the following physical and mechanical requirements:
1. Thickness: 0.217 inch
2. Weight: 1.8 lb./ft^2
3. Width: 30 inches
4. Approved Product: Paratread Roof Protection Material

H. Liquid Flashings: One-Part Liquid Flashing is a one-component polyurethane / bitumen resin that provides a liquid flashing solution for asphaltic roofing systems. Utilize fabric in three part system at all penetrations.

2.9 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Other materials shall be as shown, specified or required and be of the best grade for the proposed use as recommended by the manufacturer.
1. Expansion Joint: As detailed on drawings and outlined in NRCA and SMACNA manuals.
2. Low Level expansion joints, as noted on the drawings, to be fabricated similar to Situra Inc. “Red Line” Low level expansion joint details. Install as per manufactures recommendations and included in system warranty.
a. Approved Substitute Soprema’s “Sopra Joint”. Install as per manufacturer’s recommendations.
3. Sealant Backer Rod: Provide compressible rod stack of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, non-absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.
4. Pipe Hangers and Supports: Provide and install all necessary supports for gas lines, conduit, chilled water lines, duct work, condensate lines, etc. Refer to Section 07 72 00, Roof Accessories.
5. Relief vents, lead and other sheet metal materials shall be as specified in Section 07 62 00, Sheet Metal Flashing, Gutters, Downspouts and Trim.
6. Cant Strips: Shall be wood fiber where used for non-structural purposes. Shall be treated solid wood where used for structural purposes meeting NRCA, Factory Mutual and Underwriters Laboratory guidelines. If solid wood cant is used where insulation exists, cant is to be toe nailed into treated solid wood nailer the same height as insulation.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Environmental Requirements:
1. Apply roofing in dry weather.

2. Do not apply roofing when ambient temperature is below 45 degrees F.
3. Refer to manufacturers recommendations.

B. Field Tests:
1. Deck Dryness Test: Test for dryness before applying roofing. Should rain occur during application, retest for dryness before continuing application.
2. Foaming: Heat one Pt. of specified bitumen to 350 degrees F; pour on surface to receive roofing felts. If bitumen foams, deck is dry enough to roof.
3. Stripability: Cool bitumen poured on deck to ambient temperature and strip from surface. If any portion strips clean from deck, surface is not dry enough to roof.

3.2 ROOFING AND FLASHING - GENERAL

A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of base sheet as a continuous operation.

B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.

C. General Installation:
1. Protect adjacent areas with tarpaulin or other durable materials.
2. Installer shall prevent overspray, and be responsible for parking lot areas and/or adjoining areas not part of this contract.
3. Installer shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e. pitch dams, envelopes, and filler strips.
4. Prepare surfaces according to manufacturer's or installer's published instructions. All metal that is to receive bitumen, or come in contact with bitumen or adhesive, shall be first primed with appropriate primer. Use cleaning materials or primers necessary to render a clean and dry surface/substrate.
5. Prior to application of felts and membrane, all foreign matter, gravel, etc., shall be removed from the substrate. Gravel or debris between the substrate and plies is not acceptable.
6. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
7. Wrinkles, buckles, kinks, fishmouths, and dry voids of felt on felt are not acceptable when laying felt and membrane.
8. Primed cant strips shall be installed at the intersection of the deck and the vertical surfaces.
9. All flashings shall be mechanically top-fastened with a termination bar a minimum of six (6) inches on center at the top leading edge, and be a minimum of eight (8) inches in height from finished membrane.
10. On slopes greater than one (1) inch in 12 inches, refer to NRCA and/or manufacturer's guidelines for backnailing procedures and follow the more stringent guidelines for all specified materials.
11. Correct all errors in application the same work day they occur, including voids, fishmouths, dry laps or spots, wrinkles, ridges, blisters, bare spots, improper application, physical damage and all work not meeting specifications.

3.3 NAILERS

A. Wooden nailers shall be installed at perimeter edges or drip edges on outside perimeter of building.

B. All Construction: Nailers shall be the same height as the new lightweight insulating concrete deck or insulation being installed. Nailers shall be anchored to resist a pull-out force of 175 pounds per foot. Fasteners shall be no less than two (2) per nailer and be spaced at two (2) feet on center maximum. Provide nailers at all penetrations. Raise all curbs, flashing, etc, a minimum of ten (10) inches above the deck.

C. Provide additional nailer at all curbs to provide positive drainage away from curb.

3.4 SUBSTRATE PREPARATION

A. Lightweight Insulating Concrete Deck Systems: Nailable fills shall receive base sheet properly fastened with suitable FM approved fasteners and installed in accordance with ASCE 7 wind uplift pressure calculations.
   1. Damaged lightweight fill decks shall be removed back to solid material. Fill holes, bird baths, etc., in deck using Zonopatch as manufactured by Siplast; or equal by approved manufacturer.

3.5 APPLICATION OF BASE SHEET

A. Lightweight concrete deck shall be covered with a base sheet, mechanically fastened as follows:
   1. Install in accordance with manufacturer's current published application instructions and to meet ASCE-7 wind uplift requirements. Fasteners and fastening patterns shall be determined by building height, pull out values from lightweight insulating concrete decks (more stringent applies), location and geographical area of the United States. It is the installer's responsibility to consult current ASCE-7 publications, literature, and bulletins that are in effect at the time of this project. Submit perimeter, field and corner fastening patterns and cite all ASCE-7 data pertaining to the fastening pattern to the Architect for review.

3.6 ROOF ASSEMBLY INSTALLATION

A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of insulation as a continuous operation.

B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.

C. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.

D. Roofing Application:
   1. Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets. Lap seams between the base ply layer and the finish ply layer shall not coincide. Stagger the courses to ensure this.

a. Apply all layers of roofing perpendicular to the slope of the deck so that water flows over or along lap seams, but never against laps.
b. Fully bond the base ply to the base sheet or recover board with cold adhesive, torch, hot asphalt or mechanically attached-(Installer's option). Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps. Each sheet shall be applied directly behind the adhesive installer. Stagger end laps a minimum of three (3) feet.
c. Fully bond the finish ply to the base ply (Installer's option). Each sheet shall have a minimum of three (3) inch side and end laps. Each sheet shall be applied directly behind the asphalt installer. Stagger end laps of the finish ply a minimum of three (3) feet. Stagger side laps of the finish ply a minimum of 12 inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum of three (3) feet from end laps in the underlying base ply.
d. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes. Cold process adhesives shall be used on slopes over 1/2 inch per foot up to and including six (6) inches per foot.
e. Lap Treatment: A 20-pound roller shall be used on all side and end laps, following immediately behind application, apply uniform pressure across lap area to achieve a continuous visible bleed out. Strictly follow manufacturers guidelines on bleedout.

E. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot, to ensure a monolithic color.

3.7 ROOF ASSEMBLY FLASHING INSTALLATION

A. Flashing - General:
1. Flashings shall be installed using the manufacturer's Veral flashing membrane, with length of run not to exceed manufacturer's recommendations.
2. Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck. The nailers should be of exterior grade treated timber, and of the same thickness as any insulation to be used on the roof.
3. Cant strips shall be installed at the intersection of the deck and / or all vertical surfaces. Prime all cants.
4. The roofing field membrane shall extend up over and to the top of cant strips at all vertical intersections or out to the roof's edge.
5. All substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.
6. All flashings shall be mechanically fastened with a termination bar a maximum of six (6) inches on center, be a minimum of eight (8) inches above finished roof height, extend a minimum of nine (9) inches onto the field of horizontal roof membrane, and not exceed ten (10) linear feet of run in length.
7. Install flashing membrane in accordance with drawings and / or material manufacturer's guarantee requirements, whichever is the most stringent.

B. Flashing Application - Masonry Surfaces: Flash masonry parapet walls and curbs using the reinforcing sheet and the metal foil flashing membrane. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum three (3) inch side laps and extend a minimum of three (3) inches onto the base ply surface and three (3) inches up the parapet wall above the cant. After the final roofing ply has been

applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three (3) foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall / roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers. (See Manufacturer's schematic for visual interpretation.)

C. Flashing Application - Wood Surfaces: Flash wood or plywood parapet walls and curbs using the reinforcing sheet and metal foil flashing membrane. The reinforcing sheet shall have minimum three (3) inch side laps and extend a minimum of three (3) inches onto the base ply surface and to the top of the parapet wall, curb, etc. Nail the reinforcing sheet through the field of the sheet to the vertical wood surface on 12 inch centers from the top of the cant to top of wall curb, etc. Fully adhere the remainder of flashing reinforcing sheet that extends over the cant and roof level. After the finish ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three (3) foot widths (cut off the end of roll) always lapping the factory selvage edge. Extend the flashing sheet a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall / roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers. (See manufacturer's schematic for visual interpretation.)

D. Projection Flashings:
1. Liquid Flashings: One-Part Liquid Flashing is a one-component polyurethane / bitumen resin that provides a liquid flashing solution for asphaltic roofing systems. Utilize fabric in three part system at all penetrations.

E. Wall and Curb Flashings:
1. The flashing substrate shall be free of all dirt and loose material.
2. ¾” plywood is to be used at all parapets that receive wall flashings.
3. The underlayment ply or plies shall be brought to the top of the cant strip and adhered.
4. Starting on the roof at least six (6) inches from the roofside edge of the cant strip, adhere two (2) plies of flashing extending over the cant and up the vertical a minimum of eight (8) inches. Each lap of the ply sheet shall be a minimum of three (3) inches.
5. Starting two (2) inches past the flashing plies, install one (1) ply of SBS flashing membrane in hot asphalt. Laps shall not coincide with previously installed plies. The top of the SBS flashing shall be one (1) inch past the previously installed plies above the cant strip.
6. Fasten the top edge of the flashings on six (6) inch centers using approved termination bar and fasteners.
7. An NRCA-approved metal counterflashing shall extend down over the flashing a minimum of four (4) inches.
8. Cricket the up-side slope at all curb projections.

F. Use of Metallic Powder: Broadcast metallic powder over all bitumen overruns on the metal foil membrane surface while the bitumen is still hot to ensure a monolithic surface color.

G. Overnight Seal / Water Cut-Off:
1. Over Night Seal: Shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.
2. Water Cut-Off: At the end of day's work or when precipitation is imminent, construct a water cut-off at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to resumption of roofing.

3.8 ROOF SYSTEM INTERFACE WITH RELATED COMPONENTS

A. The following is a list of descriptions for correct installation of components integrated into the roof membrane assembly. In all cases, unless otherwise approved, incorporate flanged components into the system between the application of the base ply and finish ply. The flange must be primed with a uniform coating of approved ASTM D41 asphalt primer and allowed to dry thoroughly; all flanges must be set in approved mastic.

B. Walkway Pads:
1. Provide around all roof hatches, A/C units (if applicable) and at top and bottom of all roof access ladders.
2. Cut the material into maximum five (5) foot lengths and allow to relax until flat.
3. Adhere the sheet using the specified plastic cement. Apply the specified cement in a 3/8 inch thickness to the back of the product in five (5) inch by five (5) inch spots in accordance with the pattern as supplied by the material Manufacturer.
4. Install the walkway pad. Use a minimum spacing of two (2) inches between sheets to allow for proper drainage.
5. Walk-in each sheet after application to ensure proper adhesion.

C. Sealant: Seal all exposed finish ply edges at gravel stops, waste stacks, pitch pans, vent stacks, etc., with a smooth continuous bead of Manufacturer’s approved sealant.

D. Piping / Conduit: Provide hangers and supports as specified in Section 07 72 00, Roof Accessories. Coordinate locations with Architect.

E. Sheet Metal: Refer to Section 07 62 00, Sheet Metal Flashing, Gutters, Downspouts and Trim.

3.9 FIELD QUALITY CONTROL AND INSPECTIONS

A. Roof cuts shall be performed and repaired at installer's expense. Cuts shall be made in the areas as indicated by the Architect's representative. Send required roof cuts to roof membrane Manufacturer for laboratory examination. Roof cuts required by the Architect's representative shall be furnished to the Architect's representative for testing.

B. Remove not more than one (1) 12 inch by 12 inch cut per 5,000 square feet of roof area or fraction thereof.

C. Field audit will follow criteria outlined in current roof membrane Manufacturer's Reference Manual.

D. Repair sampled areas with "feathered in" patch consisting of same number of plies as in the roof specification.

E. Correct deficiencies in roof as prescribed in current roof membrane Manufacturer's Reference Manual and as approved by Architect's Representative.

3.10 CLEANING AND PROTECTION

A. Leave all areas around job site free of trash, debris, roofing materials, equipment, and related items after completion of job.

B. Remove bitumen stains from walls, walkways and driveways.

C. Finished roof areas shall be protected from damage by the installer during construction.

END OF SECTION

SECTION 07 62 00 - ROOF RELATED SHEET METAL

PART I – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. It is the intent of this Section that the Work shall:
   1. conform to all applicable building code requirements and of authorities having jurisdiction.
   2. include all shop and field formed sheet metal work shown on drawings, specified or required, including, but not limited to:
      a. Roof penetration sleeves and hood and umbrella counterflashing
      b. Metal counterflashing
      c. Expansion joint
      d. Roof drains
      e. Scuppers
      f. Metal perimeter edge
      g. Gutters, Downspouts, Splash Blocks and Splash Pans
      h. One-way roof moisture relief vents
      i. Metal gravity vents
      j. Metal heat exhaust vents
      k. Sanitary vent pipes
      l. Pipe box
      m. Copings, trim and miscellaneous sheet metal accessories.
   3. be part of the Work of the Roofing System; and
   4. be performed by a single source contractor.

1.3 RELATED WORK

A. Section 07 31 13 – Asphalt Roofing Shingles

B. Section 07 41 13 – Prefinished Metal Roofing

C. Section 07 52 19 - Modified Bitumen “Cool Roof” Membrane Roofing System

D. Section 07 72 00 – Roof Accessories

E. Section 13 34 19 – Pre-Engineered Metal Building System

F. All Sections of Work relating to or affecting the roofing system, including mechanical, plumbing and electrical items.

1.4 REFERENCES

A. ASTM International (ASTM)
   1. A525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   2. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
   3. B32, Standard Specification for Solder Metal

4. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

B. ASCE 7

C. Federal Specifications (FS)
1. QQ-L-201 for lead

D. National Association of Architectural Metal Manufacturers (NAAMM)

E. National Roofing Contractors Association (NRCA)
1. Roofing and Waterproofing Manual

F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
1. Architectural Sheet Metal Manual

G. ANSI / SPRI ES-1

1.5 SUBMITTALS

A. Product Data:
1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
2. Manufacturer’s installation instructions.

B. Shop Drawings: Indicating sizes, configurations, details of attachment to related and adjacent work, materials, and finishes.

C. Samples:
1) Full range of finish colors for Architect's selection.
2) 12 inch long sample of each specified item with approved finish.
3) Provide full size mockup of all shop built assemblies.
4) Documentation of Wind uplift requirements for Roof Edge for specific project location
a. Wind Calculator available online

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Fabricator and installer of roof-related flashing, installer of prefabricated edge metal and accessories shall be the same as the membrane roof installer.

B. Comply with governing codes and regulations of authorities having jurisdiction.

C. ANSI / SPRI ES-1: Install sheet metal edge flashings and copings to comply with requirements of ANSI / SPRI ES-1 / FM 1-49 for minimum of up to 150 MPH wind speed zone and wind resistance loads.

1.7 INSTALLATION CONFERENCE

A. Refer to Section 01 31 13, Project Coordination.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store materials in accordance with manufacturer's instructions.

B. Handle and store materials and equipment in such a manner as to avoid damage.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

1.9 WARRANTIES

A. Manufacturer's Product Warranty:
   1) Manufacturer's standard 30 year Kynar 500 or Hylar 5000 Finish warranty signed by the manufacturer, with guarantee covering any failure of the fluoropolymer finish during the warranty period.
   2) Failure is defined to include, but not be limited to:
      a. Deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
   3) Wind Warranty
      a. Non Coastal: up to 160 MPH Blow Off Resistance, 20 Year
   4) Correction may include repair or replacement of failed product as outlined in Warranty Documents
   5) Finish warranty and wind warranty shall be delivered by Roofing Contractor to Owner at the conclusion of project as part of project closeout documents.

B. Roofing Contractor’s Warranty:
   1. Contractor shall warrant the installation and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight and secure, for a period of five (5) years from date of Substantial Completion.
   2. Defects shall include, but not be limited to:
      a. Leaking water on the exterior of the building, causing staining or discoloration of wall / exterior surface.
      b. Leaking water or bitumen within building or construction.
      c. Becoming loose from substrate / blocking.
      d. Loose or missing parts.
      e. Finish failure as defined above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Metal Era, Inc., which is located at: 1600 Airport Rd.; Waukesha, WI 53188; Toll Free Tel: 800-558-2162; Tel: 262-549-6900; Fax: 800-373-9156; Email:request info (info@metalera.com); Web:www.metalera.com

B. Substitutions: Before proposal date upon roof consultant approval.

C. Requests for substitutions will be considered in accordance with provisions of Section 012513.

D. Manufacturers named within specification are approved for use on the Project providing:
   1. their products meet or exceed the specifications;
   2. company has a minimum of five (5) years’ experience manufacturing products of the type specified;
   3. products have been tested in conjunction with roofing membrane system as an assembly and as such has obtained the same approval and rating as the roofing membrane system; and

4. products are approved for use by the roofing membrane manufacturer.

2.2 SHEET METAL MATERIALS

A. General Requirements: Roofing sheet metal system shall have been tested in conjunction with roofing membrane system as an assembly and have the same approval and rating as the roofing membrane system.

B. Prefinished Aluminum Sheet:
1. Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209.
2. Thickness: Minimum 0.040 inch, except as otherwise indicated. SMACNA recommendations shall govern.
3. Finish: Kynar 500, color as selected by Architect from manufacturer's full range of standard and premium colors.

C. Prefinished Galvanized Sheet Steel:
1. Commercial quality ASTM A527 G-90 hot-dip galvanized coating designation.
2. Thickness: Except as otherwise indicated, minimum 24 gauge. SMACNA recommendations shall govern.
3. Finish: Kynar 500 or Hylar 5000 in color as selected by Architect from manufacturer's full range of standard and premium colors.

D. Membrane Clad Sheet Steel:
1. Commercial quality ASTM A527 with G-90 hot-dip galvanized coating designation.
2. Thickness: Except as otherwise indicated, minimum 24 gauge. SMACNA recommendations shall govern.
3. Finish: PVC / TPO coating as per Membrane Manufacturer’s requirements.

E. Sheet Lead:
1. Comply with FS QQ-L-201, Grade B
   a. Four (4) pound minimum for use at roof drains and soil stacks.

F. Stainless Steel: ASTM A167, Type 302 / 304 Soft Temper, No. 2D finish. Minimum thickness 24 gauge, except as otherwise noted.

2.3 FASTENERS

A. Same metal as flashing / sheet metal or other non-corrosive metal or as noted below.

B. Exposed fasteners shall be self-sealing and gasketed (ZAC type) for weathertight installation.

C. Match finish of exposed heads with material being fastened.

D. Mechanical Fasteners:
1. Nails: Ring shank, minimum 1-1/2 inches in length with 1/2 inch diameter head.
2. Washers: Steel washers with bonded rubber sealing gasket.
3. Screws: Self-tapping sheet metal type of stainless steel or compatible with material being fastened, with hooded integral EPDM washers (ZAC type).
4. Rivets: Stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.

E. Clips:
1. Cleat (coping / fascia): Minimum 22 gauge or .050 aluminum, G-90 galvanized, stainless steel, or aluminum. Match material of coping / fascia and provide one (1) gauge heavier.

2.4 RELATED MATERIALS

A. Solder: ASTM B32, alloy grade 58, 50 percent tin, 50 percent lead.

B. Flux:
1. Phosphoric acid type, manufacturer's standard.
   a. For Use with Steel or Copper: Rosin flux
   b. For Use with Stainless Steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Underlayment:
1. 40 mil minimum, non-reinforced, homogeneous, waterproof, impermeable elastomeric sheeting: Grace Ice and Water Shield HT, Soprema HT underlayment, Carlisle WIP 300 HT underlayment or similar product.
2. At wood blockings: Self-Adhered Flexible Flashing: 40-mil, rubberized asphalt adhesive reinforced flashing with a high density cross laminated polyethylene film. Provide compatible substrate primer as instructed by manufacturer and coordinate with specification 07 65 00.

D. Adhesives: Type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and watertightness.

E. Metal Accessories: Sheet metal clips, straps, anchoring devices, clamps and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, size and gauge recommended by installer to suit application and performance.

F. Sealant:
1. Type A:
   a. Type: One-part, non-sag, moisture-curing polyurethane sealant.
   b. Approved Products / Manufacturers: "Chem-Calk 900" manufactured by Bostik Construction Products Division, "Vulkem 921" manufactured by Mameco International, Inc., "Dynatrol I" manufactured by Pecora Corporation, "MasterSeal NP 1" manufactured by BASF, or approved equal.
2. Type B:
   a. Type: One-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
   b. Approved Products / Manufacturers: "Chem-Calk 1200" manufactured by Bostik Construction Products Division, "795 Silicone Building Sealant" manufactured by Dow Corning Corporation, "895 Silicone" manufactured by Pecora Corporation, "Omniseal" manufactured by Sonneborn Building Products, "Spectrem 2" manufactured by Tremco Incorporated, or approved equal.

G. Termination Bar:
1. Material: Stainless steel or extruded aluminum bar with lipped profile.
2. Size: 1/8 inch thick by one (1) inch wide with factory punched 1/4 inch x 3/8 inch oval holes spaced six (6) inches on center.
3. Approved Product / Manufacturer: "TB 125" manufactured by TruFast Corp., or approved equal.

H. Pipe Hangers and Supports: Refer to Section 07 72 00, Roof Accessories.

I. Splash Blocks: Concrete type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five (5) percent air entrainment. Use at locations where roof drainage discharges on ground.

J. Splash Pans: 22 gauge stainless steel, of size and profiles indicated. Use at locations where roof drainage discharges over adjoining, lower roof level(s).

2.5 FABRICATION

A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers and counterflashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.

B. Comply with manufacturer's installation instructions and recommendations.

C. Shop fabricate Thru-wall, counterflashings, expansion joint metal and wind clips to greatest extent possible.

D. Fabricate items to size and dimensions as indicated on the drawings. Limit single-piece lengths to twelve (12) feet for prefabricated pieces and ten (10) feet for shop fabricated pieces.

E. Face of any fabricated vertical metal fascia or coping shall not exceed 8” without stiffener band or birds beak. If stiffener band or birds beak cannot be fabricate, contractor to use multiple pieces of metal to achieve overall distance without going over the 8” maximum per piece.

F. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage or deterioration of the work.

G. Integrate flashing in a manner consistent with membrane waterproofing detailing. Form work to fit substrates.

H. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.

I. Fabricated items will have straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.

J. Fold back edges on concealed side of exposed edge to form hem.

K. Unless noted otherwise, lap joints minimum three (3) inch. Lap joints to have sealant installed as per details, to maintain watertight condition, inside and outside corners and elevation changes to be riveted and soldered.

L. Seams:
1. Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
2. Pre-finished Galvanized Steel: Seal pre-finished metal seams with rivets and silicone sealant.
3. Metal Other than Aluminum: Tin edges to be seamed, form seams, and solder.

M. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand metal flanges prior to applying any primers. Prime all metal in contact with bituminous material.

N. Backpaint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

O. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep filled with mastic sealant concealed within joints.

2.6 FABRICATED ITEMS

A. Metal Flashings:
1. Through Wall Receiver Tray: Minimum 24 gauge stainless steel formed in maximum ten (10) foot lengths, through wall receivers shall not extend past the face of the exterior veneer more than ¾".
2. Counterflashings: Minimum .040 prefinished aluminum, formed in maximum ten (10) foot lengths.

B. Wind Clips: Minimum 24 gauge stainless steel (or match material of counterflashing), one (1) inch wide by length to engage counterflashing a minimum of 1/2 inch. To be installed at all wall flashings and at curb flashing lengths longer than 5 feet.

C. Roof Penetrations:
1. Umbrella Counterflashing: Two-piece construction of minimum 22 gauge stainless steel, fabricated in accordance with drawings or project requirements.
2. Flashing Pans:
   a. 24 gauge stainless steel.
   b. Fabricate to provide installed minimum clear inside perimeter dimension of two (2) inches on each side of penetrating element.
   c. Fabricate pans to at least six (6) inches above the finished roof membrane and with 1/4 inch hem at top edge and with four (4) inch flanges. Round all corners of flange.
   d. Fabricate metal bonnets for all pans, NO EXCEPTIONS. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from 1/4 inch steel plate. Draw band bonnets fabricated from 22 gauge stainless steel may be used on circular projections.

D. Metal Edge / Fascia:

1. Edge Systems One "One Gravel Stop" for Modified Bitumen Roof Systems: Features a continuous cleat with pre-slotted fastening holes and staggered openings in 40% of the roof flange.
   1) Metal:
      a) .040 inch (1.01 mm) aluminum.
      b) 24 gauge galvanized steel.
   2) Finish:
      a) Kynar-500 color as selected by the Architect from roof edge manufacturer's full range of standard and premium colors.
   3) Fascia: Standard 12'-0" lengths with matching concealed joint splice plates.
   4) Splice Plates and 22 gauge galvanized continuous cleats with slotted holes are included
   5) Performance:
      a) 20 Year, 160 mph Wind Warranty.

b) Tested per ANSI / SPRI ES-1 / FM4435 Standard to a design pressure of 276 lbs./ft^2 to comply with the International Building Code.
c) Factory Mutual approved I-285 for wind up lift protection.

E. Metal Coping

1. Perma-Tite Coping
   1) Construction:
      a) Metal:
         1) .040 inch (1.01 mm) aluminum.
         2) 24 gauge galvanized steel.
      b) Finish:
         1) Kynar-500 color as selected by the Architect from roof edge manufacturer's full range of standard and premium colors.
   2) Coping Cap: Length of 12'-0", widths to 24" manufactured to job requirements. True radii may be built to template.
   3) Coping Vertical Face and Back Leg: 2 ¼" to 12 ½" manufactured to job requirements.
   4) Concealed Splice Plates: 8" wide. Finish to match finish of coping cap with factory applied dual non-curing sealant strips.
   5) Anchor / Support Cleat: 20 gauge pre-punched galvanized cleat with stainless steel spring mechanically locked to cleat normally 12" wide at 4'-0" on center. Mechanically fastened as indicated and detailed.
   6) Fasteners: 1 ½" stainless steel with driver.
   7) Performance:
      a) 20 Year, 160 mph Wind Warranty
      b) Tested per ANSI / SPRI ES-1 / FM4435 Standard to comply with the International Building Code.
      c) Factory Mutual 1-90 approved for wind up lift protection.
      d) Miami-Dade Approved (No. 13-0419.03 12/11/18) to comply with the "High Velocity Hurricane Zone of the Florida Building Code".

F. Continuous Cleats (where applicable): Continuous strips, same material and profile, minimum one gauge heavier of item which cleats attach.

G. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24 gauge stainless steel, or as shown or directed otherwise.

H. Angle Termination Bar: Aluminum pressure bar 1/8 inch x one (1) inch.

I. Gutters / Downspouts / Collector Heads: Seal-Tite Industrial Gutter System by manufacturer.
1. Minimum 0.040 inch thick prefinished aluminum formed in maximum twelve (12) foot lengths.
2. Match dimension of existing. Verify gutter and downspout meets rainfall data as outlined in SMACNA.
3. Seal-Tite Industrial Gutter, including 2" Wide Gutter Straps 24" o.c., Wind Straps 6'-0" o.c.,1/8" Stainless Steel Pop Rivits, and #10 x 2" Stainless Steel Fasteners to be manufactured and supplied to suit profile and dimension of gutter and downspout by manufacturer.
4. Supply Drip Edge at gutter.
5. For Modified Bitumen Systems: Include FlashThrough Drip Edge without Continuous Cleat.
6. 24 gauge galvanized steel with membrane manufacturer's coating (specify)

7. End Caps, Downspout Outlets, Gutter and Downspout Straps, Support Brackets and joint fasteners to be manufactured to suit profile and dimension of gutter and downspout.
8. Install all anchoring devices as outlined in manufacturer literature.
9. Expansion Joints: Style 1 per manufacturer, locate every 50 linear feet.
10. Gutter Straps and Supports: Minimum 3 per 12'-0" length, .100 inch thick downspout straps: Strap type, like metal, match color.
11. Downspouts: Minimum 0.040 inch thick prefinished aluminum (match color).
12. Downspout straps: Strap type, like metal, match color.
13. Gutter Screen: .050" Aluminum with ¼" dia. perforations

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set in place.

C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.

D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

A. Field measure site conditions prior to fabrication work.

B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4 inch hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Prefabricated corners or transitions are required at changes in direction, elevation, or plane and at intersections. Locate field joints not less than 12 inches, nor more than three (3) feet from actual corner. Laps shall be one (1) inch, riveted and soldered at following locations:
   1. Prefabricated corners;
   2. transitions;
   3. changes in direction, elevation, and plane; and
   4. at intersections.

B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible; and set units true to line and level as indicated. Install work with laps, joints, and seams which are permanently watertight and weatherproof.

C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.
   1. Ensure approved fasteners are used throughout the project.

   2. Ensure fasteners are installed in manufacturer pre-punched holes on rails, extrusions, clips and cleats.

3. Ensure sufficient amount of waterblock is applied where appropriate to prevent leaking under rails/extrusions. **Contractor is responsible for cleaning stained brick and remedying for total length of workmanship warranty if waterblock is not installed appropriately.**

D. Separations: Provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation at locations of contact as recommended by manufacturer or fabricator. Do not use materials which are incompatible with roofing system.

E. Cleat: At exposed edges of perimeter edge, fascias, cap flashings, and where required, attach cleat with appropriate fasteners supplied by roof edge manufacturer. Install cleat so fascia extends a minimum of 1 inch below top of exterior wall finish.

F. Counterflashing:
1. Do not use surface mount counterflashing except as noted in drawings.
2. Set in through wall with receiver and spring lock counterflashing, as detailed in drawings and to NRCA roofing manual, SMACNA standards.
3. Coordinate installation of through-wall flashing with the masonry contractor.
4. Seal through-wall in conjunction with masonry wall waterproofing.
5. Install wind clips 30 inches o.c. at all counterflashing over five (5) feet in length.

G. Sanitary Vent Stacks (As Required):
1. Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.
2. Fold lead sleeve down inside of pipe a minimum of one (1) inch. Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.

H. Gutters / Downspouts:
1. Install gutters prior to edge metal and otherwise as detailed.
2. Install downspouts plumb and level, attached to columns or wall with straps located at top and bottom of downspout and maximum ten (3) feet on center (note: 3 per 12’ lengths supplied by manufacturer.
3. Install splash pad or block under discharge port of downspouts (if non exist). Install splash pan over a protection (walkway) pad for downspouts located at roof level.

3.4 CLEANING AND PROTECTION

A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.

B. Remove scraps and debris and leave work area clean.

C. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.

D. Prime soldered area of phosphatized metal after cleaning to prevent rusting.

E. Paint metal flashings that have been soiled with bitumen with aluminized paint.

F. Clean other work damaged or soiled by Work of this Section.

G. Protect finished work from damage.

END OF SECTION

SECTION 07 65 00 - FLEXIBLE FLASHING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Provide flexible flashing where shown on drawings or required.

1.3 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete
B. Section 04 20 00 – Unit Masonry
C. Section 07 27 26 – Fluid Applied Air Barrier System
D. Section 07 41 13 – Prefinished Metal Roofing
E. Section 07 52 19 – Modified Bitumen “Cool Roof” Membrane Roofing System
F. Section 09 21 16 – Gypsum Wallboard Systems (Exterior Sheathing)

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Certification: Manufacturer’s affidavit that materials used in Project contain no asbestos.

C. Compatibility: Submit letter from primary Fluid Applied Air Barrier System Manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from Manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Flexible flashing materials used shall be compatible with and not void any warranties of the air barrier system used. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 MATERIALS

A. Flashing:
   1. Copper Laminated Flashing (Contractor’s Option – in lieu of asphalt-free copper fabric flashing):
      a. Flashing: A full sheet of copper weighing five (5) ounces per square foot coated or bonded on both sides with one (1) of the following:
         1) Modified asphalt compound coated.

2) Asphalt saturated, waterproof glass fiber laminated fabric.

b. Approved Manufacturers:
1) Advanced Building Products, Inc.
2) Hohmann & Barnard, Inc.
3) Sandell Manufacturing Company, Inc.
4) York Manufacturing, Inc.

c. Mastic: Manufacturer recommended asphalt troweled mastic for sealing copper laminated flashings

2. Asphalt-free Copper Fabric Flashing (Contractor's Option – in lieu of copper laminated flashing):
a. Glass fabric scrim bonded to a full sheet of copper for general through wall flashing as an alternative to asphalt coated copper specified above and where sealant compatibility is required. Provide manufacturers approved sealant or seam tape.
b. Approved Product / Manufacturer: Multi-flash 500 as manufactured by York Manufacturing, Inc.; or Copper-Fabric NA or Copper-Fabric SA as manufactured by Hohmann & Barnard, Inc. (No substitutions).

3. Asphalt-free Stainless Steel Flexible Flashing (Contractor's Option – in lieu of copper laminated or asphalt-free copper fabric flashing):
a. Flexible minimum 2 mil thickness, Type 304 stainless steel sheet with factory applied adhesive with a release liner on one side for general through wall flashing as an alternative to asphalt coated copper specified above and where sealant compatibility is required. Provide manufacturers approved sealant or seam tape.
b. Approved Product / Manufacturer: York 304 as manufactured by York Manufacturing, Inc.; or Mighty-Flash-SA as manufactured by Hohmann & Barnard, Inc. (No substitutions).

4. Membrane Flashing:
a. Self-Adhered Flexible Flashing: 40-mil, rubberized asphalt adhesive reinforced flashing with a high density cross laminated polyethylene film. Provide compatible substrate primer as instructed by Manufacturer.
b. Approved Products / Manufacturers:
1) "CCW-705 TWF" manufactured by Carlisle Coatings and Waterproofing
2) "Perm-A-Barrier" manufactured by W. R. Grace & Co.
3) "Blueskin TWF" manufactured by Henry Co.
4) "Air-Shield Through wall flashing" manufactured by W.R. Meadows, Inc.
5) ""TW-Thru Wall Flashing" manufactured by Tamko Waterproofing.
6) AquaFlash 500" manufactured by Fiberweb.

5. Substrate Primer: Provide as instructed by Membrane Manufacturer.
6. Termination Bar: 14 ga. minimum thick by 1" minimum wide stainless steel, with pre-punched holes and ¼" minimum shouldered top flange. Provide with self-tapping screws.
7. Weathering Flange at Door / Window Openings: Provide a 20 gauge (0.040") stainless steel or .040 aluminum 2"x3" weathering flange at head, jamb and under sill pan of storefront window and hollow metal door systems. Screw attach into wood blockings or substrate walls and strip into air barrier system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Flashing:

1. Follow manufacturer's instructions for mechanically fastened installation with a termination bar.
2. Application Guidelines - Install flashing at the following locations:
   a. Membrane Flashing: material transitions inside exterior cavity walls, roof edge / exterior wall transitions, masonry joints (control/expansion) inside exterior cavity walls, exterior door and window frame perimeters, roof deck / exterior wall transitions, exterior wall penetrations (i.e. pipe, conduit, ducts, etc.). Provide membrane at all joints, holes, gaps, or openings to ensure a continuously sealed building envelope. Utilize primer on substrates as instructed by manufacturer.

   b. Copper Flashing: At all horizontal wall flashing, including (but not limited to) exterior wall sill / weep conditions, exterior door and window head / weep conditions, intermediate and / or shelf angles, masonry wall cap flashing and masonry wall base flashing.
3. Apply substrate primer as instructed by membrane manufacturer to suit condition.
4. Provide drip edge flashing at weep conditions with membrane flashing. Cut ¼" to ½" behind with outside edge of brick over top of drip edge flashing to alleviate exposure to UV degradation and deterioration of asphalt membrane.
5. On Horizontal Surfaces: The flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. The flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches. Flashing will then be secured in back wall with termination bar.
6. On Vertical Surfaces: Surfaces receiving the flashing shall be sufficiently spotted with asphalt mastic to hold in place until masonry is set. Secure in back wall with termination bar.
7. Foundation Sill Dampproofing: The flashing for foundation sills shall be laid in a slurry of fresh mortar or in a full bed of mastic and topped with a fresh full bed of mortar. The flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be sloped across the cavity and turned up the wall a minimum of ten (10) inches and secured to back wall with termination bar. Where sill and column meet, flashing shall be brought up a minimum of ten (10) inches up the column.
8. Thru-Wall Flashing: Shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Carry flashing through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secure in back wall with termination bar.
9. Lintel: Premolded or field molded end dams must be provided at each end of all lintels.
10. Cavity Wall: Flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secured in the back wall with termination bar. Vertical membrane joints shall be secured with termination bar as instructed by membrane manufacturer.
11. Heads, Jambs and Sills: Flashing for heads and sills shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise. Head flashing shall be carried six (6) inches beyond both end of the steel lintel. Both head and sill

flashing shall be turned up at the sides to form a pan. All corners shall be folded, NOT CUT. Jambs are to be turned into the buildings to complete seal perimeter of window or door. Install weepholes.

12. Windows: wrap all heads, sills and jambs into opening with flexible flashings.
13. Wood blockings: Flexible flashings are to cover wood blockings in their entirety.
14. Spandrels: Spandrel flashing shall start from the outside toe of the shelf angle, go up the face of the beam and then through the wall, turned up on the inside not less than two (2) inches. Install weepholes.
15. Parapet or Coping: Flashing for parapets or coping sills shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Weepholes shall be installed immediately on top of the flashing.
16. Lengths: Install flashings without longitudinal joints within walls, if possible. If required materials are not available in a single width, join by lapping material minimum two (2) inches and seal joint throughout its length with adhesive.
17. End Joints: Avoid end joints in flashing. When end joints are necessary, lap flashing minimum six (6) inches and seal joint continuously with adhesive.
18. Penetrations: Where anchors, pipes, and inserts penetrate flashing, make opening in flashing snug and seal with adhesive.
19. Reglet Termination: Insert wedge into place and seal carefully with adhesive.
20. Termination Bar: Install flashing with termination bars in accordance with manufacturer's instructions. Provide 3 coursing at all termination bars, typical.
21. Top Coat: After flashing material is in place (except in masonry joints where bond and mortar is required) trowel full 1/8 inch protective coating or mastic on all flashing faces.
22. Lintels: Provide pre-molded end dams at all lintel ends.

B. Bed Joints: Coordinate work with Division 4, Masonry. Install thru-wall flashings between two (2) thin layers of masonry mortar without increasing thickness of mortar joint. Keep outer edge of flashing material back 3/4 inch from face of masonry.

3.2 APPLICATION

A. Protect membrane from overexposure to direct sunlight.

B. Follow manufacturer’s recommendations for installation.

C. Adjacent Work: Protect work by masking, covering, or other precautionary methods. Remove protection when no longer necessary.

END OF SECTION 07 65 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 INSTALLATION RESPONSIBILITY

A. In addition to the items normally a part of this Section, coordinate the installation of roof accessory curbs and pipe flashings and equipment supports that may be specified elsewhere.

B. Coordinate the Work specified herein with the following Work:
   1. Roofing
   2. Roofing sheet metal
   3. Mechanical equipment
   4. Plumbing
   5. Electrical

1.3 REFERENCES

A. Federal Specifications (FS)
   1. TT-S-00227E

B. National Roofing Contractors Association (NRCA)

C. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
   1. Architectural Sheet Metal Manual

1.4 SUBMITTALS

A. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Shop Drawings: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

C. Contractor to provide proof of membrane material compatibility for roof bracing and supports.(Refer to section 2.6)

1.5 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 – Project Coordination.

1.6 WARRANTY

A. Warranty the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Noticeable deterioration of finish
2. Water infiltration into the building or within the construction.

C. Rooftop supports – 5 year limited warranty.

D. Roof bracing – 20 year limited warranty included in roofing warranty.
1. Water infiltration into the building or within the construction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on products of named manufacturers. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 PREFABRICATED ROOF CURBS

A. Frames:
1. Material: ASTM A 653 G90 hot-dipped galvanized steel.
a. Minimum 18 gauge, and as engineered by manufacturer.
b. Minimum 18 gauge for curbs supporting HVAC units
c. Minimum 20 gauge for expansion joint curbs.
2. Corners: Mitered and welded (welds are micro sealed and prime painted after fabrication). Bolted connections not accepted.
3. Base Plates: Integral to frame and welded.
4. Internally reinforced with galvanized 1 inch by 1 inch by 12 gauge angles for curbs exceeding 3 foot length. Reinforce internal bulkhead at equipment curbs to support lateral loads.
5. Wood Nailers: Factory installed, pressure treated. Size and width as suitable for support of items installed on curbs.

B. Insulation: Factory installed 1-1/2 inch thick three-pound density fiberglass insulation.

C. Curb Height: Minimum 8 inch above finished roof.
1. Construct curbs to match roof slope with plumb and level top surface for mounting mechanical equipment.

D. Gasketing: 1/4 inch thick, one (1) inch wide at roof top units.

E. Counterflashing: 24 gauge stainless steel

F. Counterflashing Cap: Stainless steel.

G. Cants:
1. Non-canted curb style installs either under or on top of metal decks with insulation.
2. Cants shall be provided under Section 07 52 19 – Roofing

H. All insulated roof curbs shall be structural and shall include calculations signed and sealed by a registered Structural Engineer. Refer to installation drawings for any additional structural requirements. If curbs do not span a minimum of two bar joists, only

two angles will be required. Coordination mechanical equipment weight loading on the roof with Structural Engineer.

I. Approved Manufacturers:
   1. Custom Curb, Inc.
   2. Roof Products, Inc.

2.3 PIPE SUPPORTS (Contractor built supports are not allowed)

A. Gas Pipe Supports:
   1. Provide pipe roller type support with bases of high density / high impact injection molded polypropylene with UV inhibitors (10" x 16" x 3"; 5.5 lbs. each) and stainless steel rods, washers and nuts; Basis of design, PHP Systems / Design Model PP10-R with roller for gas pipe 3" O.D. and smaller.
   2. Provide hanger type support with bases of high density / high impact injection molded polypropylene with UV inhibitors (12" x 12" x 3"; 3 lbs. each or 18" x 18" x 3"; 7 lbs. each or 18" round; 10.5 lbs. each) and stainless steel rods, washers and nuts; Basis of design, PHP Systems / Design Model PS-1-2 with hanger for gas pipe larger than 3" O.D.
   3. Acceptable Manufacturers: Miro Industries Inc.; MAPA Products; Advanced Support Products, nVent Caddy or Architect approved equal.

B. Electrical Conduit / Condensate Pipe Supports:
   1. Provide channel / strut type support with bases of high density / high impact injection molded polypropylene with UV inhibitors (10" x 16" x 3"; 5.5 lbs. each) and stainless steel channel, rods, washers and nuts; Basis of design, PHP Systems / Design Model PP10-C with channel for condensate pipe or conduit 3" O.D. and smaller.
   2. Provide hanger type support with bases of high density / high impact injection molded polypropylene with UV inhibitors (12" x 12" x 3"; 3 lbs. each or 18" x 18" x 3"; 7 lbs. each or 18" round; 10.5 lbs. each) and stainless steel rods, washers and nuts; Basis of design, PHP Systems / Design Model PS-1-2 with hanger for condensate pipe or conduit larger than 3" O.D. Contractor to provide channel clamp at each support. Provide dissimilar metal protection as required.
   3. Acceptable Manufacturers: Miro Industries Inc.; MAPA Products; Advanced Support Products, nVent Caddy or Architect approved equal.

C. Chilled Water Pipe Supports:
   1. Provide hanger type support with bases of high density / high impact injection molded polypropylene with UV inhibitors (18" x 18" x 3"; 7 lbs. each or 18" round; 10.5 lbs. each) and stainless steel rods, washers and nuts; Basis of design, PHP Systems / Design Model PS-1-2 or Model PS-2-2 or Model PSE Custom as required with hanger(s) for chilled water pipe of any diameter.
   2. Acceptable Manufacturers: Miro Industries Inc.; MAPA Products; Advanced Support Products, nVent Caddy or Architect approved equal.

D. Crossover / Steps Pipe Supports:
   1. Provide channel / strut type support with bases of high density / high impact injection molded polypropylene with UV inhibitors and stainless steel channel, rods, washers and nuts; Basis of design, PHP Crossover.
   2. Acceptable Manufacturers: Miro Industries Inc.; MAPA Products; Advanced Support Products, nVent Caddy or Architect approved equal.

E. Installation:

1. Provide pipe supports at no greater than 8'-0" o.c. or as otherwise indicated in Manufacturer's Shop Drawings.
2. Provide pipe supports spaced so deflection of piping does not exceed 1/240 of span. If deflection exceeds 1/240 of span, decrease support spacing to 6'-0" o.c.
3. Provide complete and adequate support of all piping, ducts and conduit.
4. Provide protective isolation pads adhered to the roof system below each pipe support using Roof System Manufacturer's approved adhesive.
5. Provide each pipe support adhered to the protective isolation pads using Roof System Manufacturer's approved adhesive.

2.4 ROOF TO ROOF EXPANSION JOINT

A. Stainless Steel expansion joint covers on new wood curbs, as detailed on drawings and outlined the NRCA and SMACNA manual.

2.5 ROOF PENETRATION HOUSING

A. Provide rain-proof our-piece configuration consisting of a removable vandal resistant lid, middle housing, insulation extension (ICE) and wide flanged curb that is light weight and water tight. To be used with our exclusive two-piece aluminum and / or stainless steel flanged Exit Seal with SilX14TM gasket. Provide 20 Year insured warranty.

B. As manufactured by Roof Penetration Housing Model AWI Series Vault as required for condition or Architect approved equal.

2.6 ROOF DRAIN / DOWNSPOUT WALL NOZZLE

A. Downspout Wall Nozzle at Concealed Roof Drain Leader / Discharge: Josam 25010 Series cast bronze Downspout Nozzle with loose flange and inlet threaded connection or Architect approved equal. Diameter appropriate to downspout size.

2.7 PLUMBING PEDESTAL HYDRANT

A. Provide freeze-proof pedestal hose station / hydrant with stainless steel shroud, welded stainless steel flange, black powder coated cast aluminum dome handle, mail hose fitting and vacuum breaker. Provide powder coated under-deck support flange with hardware. Provide for dissimilar metal protection.

B. As manufactured by MAPA Products Model MPH-24D:24/9 Pedestal Hydrant as required for condition or Architect approved equal.

2.8 ELECTRICAL PEDESTAL DISCONNECT / OUTLET

A. Provide rain-proof pedestal disconnect with stainless steel square tubing and welded stainless steel flange. Provide powder coated under-deck support flange with hardware. Provide for dissimilar metal protection.

B. As manufactured by MAPA Products Model MPD-(XX) Pedestal Disconnect as required for condition or Architect approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof accessories in accordance with manufacturer's printed instructions and approved shop drawings. Installation of Portable Pipe Hangers shall not exceed six (6) feet on center.

B. Coordinate with roofing operation for watertight integrity.

C. Finished installation shall be water and air tight. Install sealant conforming to FS TT-S-00227E, Type II, Class A.

END OF SECTION

SECTION 07 72 33 - ROOF SCUTTLE (HATCHES) AND HEAT/SMOKE VENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 RELATED WORK

A. Section 03 32 16- Lightweight Insulating Concrete Deck System

B. Section 05 31 00 - Metal Deck

C. Section 05 50 00 - Miscellaneous Metals

D. Section 06 10 00 - Rough Carpentry

E. Section 07 52 19 – Modified Bitumen Membrane Roofing System

1.3 SUBMITTALS

A. Product Data: Submit schedules, charts, literature and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Shop Drawings: Include materials, opening sizes, fabrication details, hardware, attachments, related and adjacent work, and finishes.

1.4 WARRANTY

A. Warrant the work specified herein for five (5) years, against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
1. Faulty, improper or inadequate attachment or installation.
2. Difficult or noisy operation.
3. Noticeable deterioration of finish.
4. Leakage of water into the building or within the construction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on products manufactured by The Bilco Company.

B. Manufacturers listed below whose products are equivalent to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
1. Acudor Products Inc.
2. Babcock-Davis Hatchways, Inc.
3. Dur-Red Products
4. J. L. Industries, Inc.

5. Karp Associates, Inc.
6. Nystrom Building Products

2.2 ROOF SCUTTLES (HATCHES)

A. Size: 2 feet-6 inches x 3 feet-0 inches, unless shown otherwise.

B. Thermally Broken Cover: Shall be 11 gauge aluminum with 3" concealed polyisocyanurate insulation, 5" beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf live load., fully covered and protected by an aluminum liner.

C. Thermally Broken Curb: Shall be 12 inches in height and of 11 gauge aluminum. It shall be formed with a 5-1/2 inch flange with holes provided for securing to the roof deck. Curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, full welded at the corners for weathertightness. Capflashing shall be equipped with the Bilclip™ flashing system, including stamped tabs and Pak-Rope. Insulation on the exterior of the curb shall be rigid fiber board three (3) inches in thickness.

D. Thermally Broken Scuttle (Hatch): Shall be completely assembled with heavy pintle hinges, positive snap latch with turn handles, padlock hasps inside and outside, and a mechanically retained thermoplastic rubber gasket. Compression spring operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. Cover shall be equipped with an automatic hold-open arm complete with red vinyl grip handle to permit easy release and one-hand control of the cover to its closed and latched position. All hardware shall be stainless steel. Scuttle factory finish shall be mill finish aluminum.

E. Approved Model / Manufacturer: Type No. “S-50TB” Roof Scuttles (Hatches) for ladder access, or Architect approved equal.

F. Ladder: As specified in Section 05 50 00, Miscellaneous Metals. Ladder shall be oriented and mounted along the short dimension of the hatch.

G. Fall Protection Safety Rail: 30”x36” Model SP-3036 Made by **SafePro L.C.**

2.3 HEAT AND SMOKE VENTS

A. Size: 4 feet-0 inches x 8 feet-0 inches unless shown otherwise.

B. Covers: Shall be 11 gauge aluminum with three (3) inch beaded flange and formed reinforcing members welded to support a minimum live load of 40 lb / sq.ft. Insulation shall be of glass fiber, one (1) inch in thickness, fully covered and protected by a 18 gauge aluminum cover liner. No water standing on top of the cover will be permitted.

C. Curb: Shall be of 11 gauge aluminum, 12 inches in height on hinge sides with a five (5) degree pitch to the fixed center channel. Curb shall be formed with a 3-1/2 inch flange with holes for securing to the roof deck and with an integral metal capflashing of the same gauge and material as the curb, full welded for weathertightness. Capflashing shall be equipped with the Bilclip™ flashing system, including stamped tabs and Pak-Rope. Insulation on the exterior of the curb shall be rigid fiberboard three (3) inches in thickness. All hardware shall be zinc plated and chromate sealed. Factory finish shall be mill finish aluminum.

D. Vent: Shall be completely assembled with a Thermolatch(R) positive hold/release mechanism designed to hold the covers in the closed position against 90 lb/sq.ft.) wind uplift forces without overstressing the fusible link. Each cover shall have a minimum of three (3) heavy pintle hinges, a mechanically retained thermoplastic rubber gasket, heavy duty shock absorbers and pull handles for inside and outside operation. Vent shall open automatically when heat breaks the 165 degrees F fusible link and shall be labeled as being FM Approved or UL Listed.

E. Approved Model / Manufacturer: Fire Vent Type DSH4896 Double Leaf Fire Vents or Architect approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof hatches and heat / smoke vents shall be welded to structural steel frame of building.

B. Install hatches and heat / smoke vents in accordance with details on drawings, approved shop drawings, and manufacturer's instructions.

END OF SECTION

SECTION 07 81 00 - APPLIED FIREPROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Sprayed fire resistive materials.
   2. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 07 21 00 – “Thermal Insulation.”

1.4 DEFINITIONS

A. SFRM: Sprayed fire resistive materials.

1.5 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Consider steel members unrestrained unless specifically noted otherwise.

C. Asbestos: Provide products containing no detectable asbestos.

1.6 SUBMITTALS

A. Product Data: Technical data, installation instructions, and UL listing for each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
   1. Extent of fireproofing for each construction and fire resistance rating.
   2. Applicable fire resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum fireproofing thickness necessary to achieve required fire resistance rating of each structural component and assembly.
   4. Treatment of fireproofing after application.

C. Samples: Submit for each exposed product and for each color and texture specified, 4 inches (102 mm) square in size.

D. Product Certificates and Reports:
   1. Certificates: Submit manufacturer’s precut certificates for each type of SFRM.
   2. Evaluation Reports: Submit ICC-ES evaluation report.
   3. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating:
      a. Materials have been tested for bond with substrates.
      b. Materials have been verified by SFRM manufacturer to be compatible with substrate and coatings.
      c. Interpretation of test results and written recommendations for substrate preparation needed for adhesion.
   4. Preconstruction test reports.
   5. Field quality control reports.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable provisions of the IBC for fire protection.

2. Fire Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency. Steel members are to be considered unrestrained unless specifically noted otherwise.
3. Surface Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame Spread Index: 10 or less.
   b. Smoke Developed Index: 10 or less.
4. Hazardous Materials: Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, Polarized Light Microscopy.

B. Installer Qualifications: A firm or individual having minimum 5 years documented experience who is certified or licensed and qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

C. Source Limitations: Obtain fireproofing for each fire resistance design from single source.

D. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified.
3. Verify that manufacturer, through its own laboratory testing or field experience, attests that coatings are compatible with fireproofing.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures.

E. Preinstallation Conference: Conduct conference at site.
1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life, and fire resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from site and discard wet or deteriorated materials.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 degrees F (7 degrees C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

1.10 COORDINATION

A. Sequence and coordinate application of sprayed fireproofing with related work to comply with requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
2. Provide temporary enclosures for applications to prevent deterioration of fire resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fire resistive material to abrasion and damage likely to occur during construction operations subsequent to its application.
4. Do not apply fire resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire resistive material.
5. Do not apply fire resistive material to metal floor deck substrates until concrete topping has been completed.
6. Do not begin applying fire resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fire resistive material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fire resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.11 WARRANTY

A. Written warranty signed by manufacturer, installer, and Contractor in which manufacturer agree to repair or replace fireproofing materials that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of SFRM from substrates.
      b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire response testing, and other causes not reasonably foreseeable under conditions of normal use.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design: Islolatek International. Other manufacturers are subject to compliance with requirements.
   1. Grace Construction Products.
   2. Carboline Company; a subsidiary of RPM International.
   3. Southwest Fireproofing Products Co.

B. Sprayed Fire Resistive Material: Factory mixed, lightweight, dry formulation, complying with indicated fire resistance design, and mixed with water at site to form a slurry or mortar before conveyance and application.
   1. Application: Designated for exterior use by qualified testing agency acceptable to authorities having jurisdiction.
   2. Bond Strength: Minimum 150 lbf/sq. ft. (7.18 kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
   3. Density: Not less than density specified in the approved fire resistance design, according to ASTM E 605.
   4. Thickness: As necessary required for fire resistance design indicated, measured according to requirements of fire resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
   5. Combustion Characteristics: ASTM E 136.

6. Compressive Strength: Minimum 1,400 psf (68.9 kPa) according to ASTM E 761.
7. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
8. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
11. Fungal Resistance: Treat products with antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.
12. Finish: Spray textured finish unless otherwise indicated.

C. Auxiliary Materials: Provide auxiliary materials compatible with fireproofing and substrates and approved by UL for use in fire resistance designs indicated.
1. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL Fire Resistance Directory.
2. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire resistance designs indicated and fireproofing manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
3. Reinforcing Fabric: Glass or carbon fiber fabric of type, weight, and form required to comply with fire resistance designs indicated; approved and provided by fireproofing manufacturer.
4. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for substrates and conditions affecting performance of the work and according to each fire resistance design.
1. Verify substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Verify objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
4. Verify concrete work on steel deck is complete before beginning fireproofing work.
5. Verify roof construction, installation of rooftop HVAC equipment, and related work are complete before beginning fireproofing work.
6. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
7. Prepare written report listing conditions detrimental to performance of the work.
8. Proceed with installation after correcting unsatisfactory conditions.

B. Conduct tests according to fireproofing manufacturer's written recommendations to verify substrates are free of substances capable of interfering with bond.

C. Prepare written report listing conditions detrimental to performance of the work.

D. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Cover adjacent work subject to damage from fallout or overspray of fireproofing materials during application. Clean substrates of substances that could impair bond of fireproofing.

B. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless in satisfactory condition to receive fireproofing.

C. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:
   1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
   2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
   1. For applications over encapsulant materials, including lockdown (post removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.
   2. Where sealers are used, apply products that are tinted to differentiate them from fireproofing over which they are applied.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
   1. Cure fireproofing according to fireproofing manufacturer's written instructions.

I. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

J. Cure fireproofing according to fireproofing manufacturer’s written instructions.

K. Finishes: Where indicated, apply fireproofing to produce the following finishes:
   1. Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
   2. Spray Textured Finish: Finish left as spray applied with no further treatment.

3. Rolled, Spray Textured Finish: Even finish produced by rolling spray applied finish with a damp paint roller to remove drippings and excessive roughness.
4. Skip Troweled Finish: Even leveled surface produced by troweling spray applied finish to smooth out the texture and neaten edges.
5. Skip Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray applied finish to smooth out the texture, eliminate surface markings, and square off edges.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Test and inspect as required by the IBC, Subsection 1705.13 and indicated in Schedule of Special Inspections.

B. Perform the tests and inspections of completed work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
   2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel applied product.

END OF SECTION 07 81 00

SECTION 07 81 23 - INTUMESCENT FIREPROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Mastic and intumescent fire resistive coatings.
   2. Accessories necessary for a complete installation.

1.3 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

D. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.4 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire resistance design and manufacturer's written instructions.

B. Fire Resistance Design: Indicated on Drawings, tested according to ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. Surface Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame Spread Index: 25 or less.
   2. Smoke Developed Index: 450 or less.

D. Asbestos: Provide products containing no detectable asbestos.

1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
   1. Extent of fireproofing for each construction and fire-resistance rating.
   2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
   4. Treatment of fireproofing after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

D. Qualification Data: For Installer and testing agency.

E. Product Certificates: For each type of fireproofing.

F. Evaluation Reports: For fireproofing, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockup of each type of fireproofing and different substrate and each required finish.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Pre-Installation Conference: Conduct conference at Project site.
   1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 degrees F (10 degrees C)] or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 PRODUCTS

2.1 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Interior Mastic and Intumescent Fire Resistive Coating: Factory mixed formulation consisting of intumescent base coat and topcoat (if required), and complying with indicated fire resistance design.
   1. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
      a. Albi Manufacturing; a division of StanChem, Inc.
      b. Carboline Company; a subsidiary of RPM International.
      c. Isolatek International.
   2. Basis of Design: "CAFCO SprayFilm WB 5 System" as manufactured by Isolatek International
   3. Interior Application: Designated for "interior general purpose" "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
   4. Thickness: Required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
   5. Hardness: Not less than 65 Type D durometer, according to ASTM D2240.
   6. Finish: As selected by Architect from manufacturer's standard finishes or spray-textured finish.
      a. Color and Gloss: As indicated by manufacturer's designations, match Architect's sample or as selected by Architect from manufacturer's full range.

B. Exterior Mastic and Intumescent Fire Resistive Coating: Factory mixed formulation consisting of intumescent base coat and topcoat, and complying with indicated fire resistance design.

1. Manufacturers: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   a. Albi Manufacturing; a division of StanChem, Inc.
   b. Carboline Company; a subsidiary of RPM International.
   c. Isolatek International.
2. Basis of Design: "CAFCO SprayFilm WB 4 System" as manufactured by Isolatek International
3. Exterior Application: Designated for "exterior" use by a qualified testing agency acceptable to authorities having jurisdiction.
4. Thickness: Required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
5. Hardness: Not less than 65 Type D durometer, according to ASTM D2240.
6. Finish: As selected by Architect from manufacturer's standard finishes or spray-textured finish.
   a. Color and Gloss: As indicated by manufacturer's designations, match Architect's sample or as selected by Architect from manufacturer's full range.

2.2 AUXILIARY MATERIALS

A. Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
   1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulate, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
   2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

I. Cure fireproofing according to fireproofing manufacturer's written instructions.

J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fireproofing to produce the following finish.
   1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Test and inspect as required by the IBC.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
   2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to Work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 23

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SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated constructions.
   2. Joints at exterior curtain-wall/floor intersections.
   3. Joints in smoke barriers.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

C. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2023b.

D. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.

E. FM 4991 - Approval Standard of Firestop Contractors; 2013.

F. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Qualification Data: For Installer.

D. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 'sFM 4991, "Standard for the Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."
         2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.
   1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
   1. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
   3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Control and expansion joints on exposed surfaces.
   2. Perimeter joints between wall surfaces and frames of doors and openings.
   3. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   4. Joints indicated or as necessary.
   5. Accessories necessary for a complete installation.

1.3 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

B. ASTM C834 - Standard Specification for Latex Sealants; 2017.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

J. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.4 SUBMITTALS

A. Product Data: Technical data for each joint sealant product. Submit written certification from manufacturers of sealants attesting products are suitable for use indicated, verified through in house testing laboratory.
   1. Written certification from manufacturers of joint sealants attesting that products comply with specification requirements and suitable for use indicated verified through manufacturers testing laboratory within the past 36 months or since most recent reformulation, whichever is most recent.
      a. Complete instructions for handling, storage, mixing, priming, installation, curing and protection of each type of sealant.
      b. Manufacturer's letter, clearly indicating proposed lot numbers of each sealant supplied and expiration date sequence.
      c. Instructions for handling, storage, mixing, priming, installation, curing, and protection of each type of sealant.
   2. VOC Data: Submit manufacturer’s product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.

3. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

B. Certificates and Reports:
1. Product Certificates: Manufacturer's product certificate for each kind of joint sealant and accessory.
2. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
4. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
a. Materials forming joint substrates and sealant backings have been tested for compatibility and adhesion with sealants.
b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
5. Preconstruction Field Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified.
6. Field Adhesion Test Reports: For each sealant application tested.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm having minimum 5 years documented experience and specializing in the installation of sealants.
1. Exposed sealant work (sealants used for air and weatherseals external to curtain wall systems at perimeter, metal panel to panel joints) shall be performed by a single (i.e. one) firm specializing in the installation of sealants who has successfully produced work comparable to project.
2. Concealed sealant work (sealants which are internal to metal framed curtain wall systems, skylights, and providing an air seal) shall be the responsibility of the subcontractor providing erection of the respective system.

B. Source Limitations: Obtain each type of joint sealant from a single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
2. Test according to SWRI Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion in peel, and indentation hardness.

D. Environmental Requirements:
1. Toxicity/IEQ: Comply with applicable regulations regarding toxic and hazardous materials.
a. VOC Content of Interior Sealants: Refer to 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions for VOC limits of sealants installed within the building.
b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer written instructions to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F (4.4 degrees C).
   2. When joint substrates are wet. Should joints or backing materials become wet, remove and replace backing material with new.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealant work which has failed to provide a weathertight system within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Warranties: Written warranties (weatherseal and stain resistance), signed by sealant manufacturer agreeing to furnish joint sealants to repair or replace those that fail to provide airtight and watertight joints, or fail in adhesion, cohesion, abrasion resistance, stain resistance, weather resistance, durability, or appear to deteriorate in manner not specified in the manufacturer's data as an inherent quality of the material within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion, 20 years for silicone sealants.

C. Warranties specified exclude deterioration or failure of sealants from:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backings, and related materials compatible with one another and with joint substrates, air barrier system, and masonry under conditions of service and application, as stated by sealant manufacturer’s published data, and as substantiated by the manufacturer for each application through testing.

B. Liquid Applied Sealants: Comply with ASTM C920 and requirements indicated for each liquid applied sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain Test Response Characteristics: For sealants in contact with porous substrates, provide non-staining products that have undergone testing according to ASTM C1248 and do not stain porous joint substrates.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors: For fully concealed joints, provide standard color of sealant that has the best overall performance characteristics for the application shown. For exposed joints, match adjacent surface. For exposed joints, submit color samples to architect for approval, from manufacture’s full line of standard colors.

F. Manufacturer's Representative: Use sealant produced by manufacturer who agrees to send a qualified technical representative to site upon request for the purpose of rendering advice concerning the recommended installation of manufacturer's materials.

G. Sealants: Self leveling compounds for horizontal joints in pavements and non-sag compounds elsewhere except as shown or specified.

H. Silicone Sealant: ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O.
   1. Use: Precast Concrete Joints between metals, glass, and plastics (Two part silicone sealants).
   2. Properties: Performance: Non-staining, non-bleeding, and non-streaking to sealed and adjacent substrates. The minimum pli value after 7 day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion and Peel.
   3. Cure System and Oil Content: Neutral Cure System specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
   4. Product and Manufacturer: Dow Corning; 756 Silicone Building Sealant - HP with Additive.

I. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 50, use NT.
   1. Use: Precast Concrete Joints between metals, glass, and plastics (Single component sealants).
   2. Properties: Performance: Non-staining, non-bleeding, and non-streaking to sealed and adjacent substrates.
   3. Cure System and Oil Content: Neutral Cure System specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
   4. Product and Manufacturer:
      a. BASF Building Systems; Omniseal 50.
      b. Dow Corning Corporation; 756 SMS, 791, 795, 995 as applicable.
      c. GE Advanced Materials, Silicones; SilGlaze II SCS2800, SilPruf NB SCS9000, SilPruf SCS2000, or UltraPruf II SCS2900 as applicable.
      d. Sika Corporation, Construction Products Division; SikaSil-C995.

J. Polyurethane Sealants: ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O.
   1. Use: Typical Wall and Floor Joints (Two part polyurethane sealants).
   2. Properties: Performance: Non-staining, non-bleeding, non-streaking to sealed and adjacent substrates.
   3. Products and Manufacturers:
      a. BASF Building Systems; Sonolastic NP-2.
      b. Pecora Corporation; Dynatred.
      c. Sika Corporation, Construction Products Division; Sikaflex 2c NS or Sikaflex 2c NS TG as applicable.

K. Two Part Polyurethane Sealants: ASTM C920, Type M, Grade NS, Class 50; use NT, M, A and O.
   1. Use: Typical Wall and Floor Joints (Two Part Polyurethane Sealants).
   2. Properties: Performance: Non-staining, non-bleeding, and non-streaking to sealed and adjacent substrates. The minimum pli value after 7 day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion in Peel.
   3. Products and Manufacturers: One of the following:
      a. Schnee-Morehead, Inc.; Permathane SM 7200.
      b. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
      c. BASF Construction Chemicals; NP 2.

L. Mildew Resistant Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, Substrate uses G, A, and O; and containing fungicide for mildew resistance; acid curing.
   1. Use: Joints at toilet fixtures, toilet room countertops and vanities, wet areas, and janitor closet mop receptor to wall transition.

2. Products: Provide one of the following:
    a. BASF Building Systems; Omniplus.
    b. Dow Corning; 786 Mildew Resistant Silicone Sealant.
    c. GE Silicones; Sanitary SCS 1700.

M. Latex Sealant: Non-elastomeric, one part, non-sag, paintable latex sealant that is recommended for exposed applications on the interior. Complying with ASTM C834, Type OP (opaque sealants):
    1. Products: Subject to compliance with requirements, provide one of the following:
        a. Pecora Corporation; AC-20 + Silicone.
        b. BASF; Sonolastic Sonolac.

N. Acoustical Joint Sealant: Non-sag, paintable, non-staining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
    1. Products: Subject to compliance with requirements, provide one of the following:
        a. Hilti, Inc.
        b. Pecora Corporation; AC-20 FTR or AIS-919.
        c. Specified Technologies, Inc.
        d. USG Corporation; SHEETROCK Acoustical Sealant.

O. Sealant Backing: Provide sealant backings that are non-staining; compatible with joint substrates, sealants, primers, and joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
    1. Cylindrical Sealant Backings: Preformed, compressible, resilient, non-staining, non-waxing, non-extruding backings of flexible plastic foam complying with ASTM C1330, and of type indicated below. Select shape and density of cylindrical sealant backings in consultation with the manufacturer for proper performance in specific condition of use in each case.
    2. Type C: Closed cell polyethylene foam material with surface skin, nonabsorbent to liquid water and gas, non-outgassing in unruptured state; one of the following:
        a. HBR Closed Cell Backer Rod; Nomaco, Inc.
        b. Sonolastic Closed-Cell Backer-Rod; BASF Construction Chemicals.

P. Butyl Mastic Tape: High-tack, self-fusing butyl rubber mastic.
    1. Compatible with air barrier system.
    2. Locations: At masonry veneer anchors and where indicated on Drawings.
    3. Products: “Butyl Mastic Tape 2212” as manufactured by 3M or architect approved equal.

Q. Miscellaneous Materials:
    1. Primer: Material recommended, as verified through compatibility and adhesion testing, by joint sealant manufacturer for the substrates indicated to be sealed.
    2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
    3. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and which will not stain nor mar the finish of surface adjacent to joints to which it is applied.
    4. Cork Joint Filler: Resilient and non-extruding ASTM D1752, Type II.
    5. Bond Breaker Tape: Polyethylene, TFE fluorocarbon, or plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants for compliance with requirements for joint configuration, installation tolerances, and conditions affecting sealant performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with the recommendations of joint sealant manufacturer and requirements:
   1. Remove foreign material from joint substrates interfering with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, oil, grease, water, surface dirt, and frost.
   2. Clean concrete, masonry, unglazed surfaces of tile and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil free compressed air.
   3. Remove laitance and form-release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on prior testing and experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Silicone Glazing Sealants: Refer to Section 08 80 00 - Glazing.

B. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

C. Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants applicable to materials, applications, and conditions indicated.

D. Sealant Backings: Install sealant backings to support sealants during application and at position necessary to produce cross sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings. Trim for tight fit around obstructions or elements penetrating the joint.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that become wet before sealant application and replace with dry sealant backings.
   4. Install bond breaker tape behind sealants where backings are not used between sealants and back of joints.

E. Weeps and Vents: Install weeps and vents into joints at the same time sealants are being installed. Locate weeps and vents spaced recommended by sealant manufacturer and the window and curtain wall fabricator and erector. Do not install weeps and vents at outside building corners. Do not install vents at horizontal joints immediately below shelf angles, sills, and through wall flashings.

F. Sealants: Install sealants by proven techniques resulting in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at same time sealant backings are installed.
   1. Apply sealants in depth in accordance with manufacturer's recommendations and recommended general proportions and limitations.
   2. Apply elastomeric sealants, in joints not subject to traffic or abrasion, to a depth equal to 50% of the joint width, but not less than 1/4 inch (6 mm) and not more than 1/2 inch (13 mm).
   3. Apply non-elastomeric sealants to a depth approximately equal to the joint width.

G. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform, beads to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces. Tool exposed surfaces of sealants to the profile shown, or if none is shown, tool slightly concave.
   1. Use masking tape to protect adjacent surfaces of recessed tooled joints.
   2. Provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.
   3. Against rough surfaces or in joints of uneven widths avoid the appearance of excess sealant or compound by locating the compound or sealant well back into joint wherever possible.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

I. Acoustical Sealant Installation: At sound rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field Adhesion Testing: Field test exterior wall joint sealant adhesion to joint substrates:
   1. Extent of Testing: Test completed and cured sealant joints:
      a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
      b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
   2. Test Method: Test joint sealants according to Method A, Field Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer field adhesion hand pull test criteria.
   4. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work. Coordinate interior application of sealants with interior finishes schedule.

3.6 CLEANING AND PROTECTION

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

B. Protect joint sealants during and after curing from contact with contaminating substances and from damage so sealants are without deterioration or damage at time of Substantial Completion. If, despite protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 92 00

SECTION 07 95 00 - EXPANSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Expansion joint cover assemblies.
   2. Accessories necessary for a complete installation.

1.3 PERFORMANCE REQUIREMENTS

A. Expansion Joint Design Criteria:
   1. Type of Movement: Thermal and wind sway.
      a. Nominal Joint Width: Indicated on Drawings.
      b. Minimum Joint Width: Indicated on Drawings.
      c. Maximum Joint Width: Indicated on Drawings.

1.4 SUBMITTALS

A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Shop Drawings: Submit for each expansion joint cover assembly.
   1. Include plans, elevations, sections, details, splices, block out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
   2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion joint cover assembly.
   2. Expansion joint cover assembly location cross-referenced to Drawings.
   3. Nominal, minimum, and maximum joint width.
   4. Movement direction.
   5. Materials, colors, and finishes.
   6. Product options.
   7. Fire resistance ratings.

D. Product Test Reports: For each fire resistance rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E 1966 by a qualified testing agency.

a. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate. Apply protective coating on aluminum surfaces in contact with cementitious materials.

B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

D. Moisture Barrier: Flexible elastomeric material. Continuous, waterproof membrane within joint and attached to substrate on sides of joint. Provide where indicated on Drawings.

E. Nonmetallic, Shrinkage Resistant Grout: ASTM C 1107/C 1107M, factory packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30 minute working time.

F. Fasteners: Recommended attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 FLOOR EXPANSION JOINT COVERS

A. Metal Plate Floor Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
      b. Construction Specialties, Inc.
      c. InPro Corporation (IPC).
      d. MM Systems Corporation.
      e. Watson Bowman Acme Corp.
      f. Balco.

   2. Application: Floor to wall.
   3. Installation: Surface mounted.
   4. Load Capacity:
      a. Uniform Load: 50 lb/sq. ft. (244 kg/sq. m).
      b. Concentrated Load: 300 lb (136 kg).
      c. Maximum Deflection: 0.0625 inch (1.6 mm).

   5. Fire Resistance Rating: Not less than indicated on Drawings and adjacent construction.
   6. Cover Plate Design: Plain.
   7. Exposed Metal: Aluminum, clear anodic, Class I.

B. Elastomeric Seal Floor Joint Cover: Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Architectural Art Manufacturing Inc.
   b. Construction Specialties, Inc.
   c. EMSEAL Joint Systems, Ltd.
   d. InPro Corporation (IPC).
   e. MM Systems Corporation.
   f. Watson Bowman Acme Corp.
   g. Balco.

2. Application: Floor to floor.
3. Installation: Indicated on Drawings.
4. Load Capacity:
   a. Uniform Load: 50 lb/sq. ft. (244 kg/sq. m).
   b. Concentrated Load: 300 lb (136 kg).
   c. Maximum Deflection: 0.0625 inch (1.6 mm).

5. Fire Resistance Rating: Not less than that indicated on Drawings and adjacent construction.
6. Exposed Metal: Aluminum, clear anodic, Class I.
7. Seal: Preformed elastomeric membrane or extrusion.

2.3 WALL EXPANSION JOINT COVERS

A. Metal Plate Wall Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
      b. Construction Specialties, Inc.
      c. InPro Corporation (IPC).
      d. MM Systems Corporation.
      e. Watson Bowman Acme Corp.
      f. Balco.

   2. Application: Wall to wall.
   3. Fire Resistance Rating: Not less than indicated on Drawings and adjacent construction.
   4. Exposed Metal: Aluminum, clear anodic, Class I.

2.4 CEILING EXPANSION JOINT COVERS

A. Metal Plate Ceiling Joint Cover: Metal cover plate fixed on one side of joint gap and free to slide on other.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Art Manufacturing Inc.
      b. Construction Specialties, Inc.
      c. InPro Corporation (IPC).
      d. MM Systems Corporation.
      e. Balco.

   2. Application: Wall to ceiling.
   3. Fire Resistance Rating: Not less than indicated on Drawings and adjacent construction.
   4. Exposed Metal: Aluminum, Clear anodic, Class I.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

C. Furnish units in longest practicable lengths to minimize field splicing.

D. Include factory fabricated closure materials and transition pieces, T joints, corners, curbs, cross connections, and other accessories as required to provide continuous expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
   1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage resistant grout.
   2. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
   5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   1. Provide in continuous lengths for straight sections.

2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

F. Fire Resistance Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Provide items shown on the drawings and specified, including, but not limited to the following:
   1. Standard and fire rated hollow metal doors
   2. Hollow metal frames for doors, sidelites, transoms, and windows.

1.3 RELATED WORK

A. Section 04 20 00 - Unit Masonry.

B. Section 05 40 00 – Cold-Formed Metal Framing.

C. Section 05 50 00 – Metal Fabrications.

D. Section 08 14 23 – Plastic-Laminate-Faced Wood Doors.

E. Section 08 80 00 - Glazing: Glazing in doors, sidelites, transoms, and windows.

F. Section 09 91 00 - Paintings and Coatings.

1.4 REFERENCES

A. American National Standards Institute (ANSI)
   1. A115.IG, Installation Guide for Doors and Hardware.
   2. A224.1, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors & Frames.
   3. A250.8, Recommended Specifications for Standard Steel Doors and Frames.
   4. A250.11, Recommended Erection Instructions for Steel Frames.

B. ASTM International (ASTM)
   1. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   3. A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   4. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   5. C1363 - Standard Test Method for the Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

6. E283 – Standard Test Method for Determining the rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
7. E413 - Standard Classification for Rating Sound Insulation

C. Federal Specification (Fed Spec)
1 Fed Spec C578 Bead Fusion Test.

D. Hollow Metal Manufacturers Association (HMMA)
1. HMMA 802 - Manufacturing of Hollow Metal Doors and Frames.
2. HMMA 810 - Hollow Metal Doors.
3. HMMA 830 - Hardware Preparation and Locations for Hollow Metal Doors and Frames.
4. HMMA 840 - Installation and Storage of Hollow Metal Doors and Frames.
5. HMMA 850 - Fire Rated Hollow Metal Doors & Frames.
6. HMMA 890 - Technical Summary of Hollow Metal by HMMA.

E. National Fire Protection Association (NFPA)
1. 80, Fire Doors and Fire Windows.
2. 252, Fire Tests of Door Assemblies.

F. Steel Door Institute – Current Standards
1. Technical Data Series.

G. Underwriters Laboratories Inc. (UL)
1. Building Materials Directory.
2. Listing and Labeling.
3. 10B and 10C, Fire Tests of Door Assemblies.
4. 1784, Air Leakage Tests of Door Assemblies.

H. Intertek Testing, Services (Warnock Hersey, Inc. (WHI))
1. Listing and Labeling.

1.5 SUBMITTALS

A. Product Data:
1. Manufacturer's standard details and catalog data demonstrating compliance with specifications and referenced standards.
2. Manufacturer's installation instructions.

B. Shop Drawings:
1. Indicate complete schedule in detail for each steel door and frame using the same reference number for details and openings as those on the Contract Drawings. If any door is not by the steel door manufacturer only the door opening number should be shown along with the type of door (wood, plastic laminate faced, etc.).
2. Show details of construction, installation, connections, anchors, hardware reinforcement, hardware preparation, and floor and threshold clearances.

C. Samples are required from non-Steel Door Institute members:
1. 12 inch x 12 inch sample of a fire-rated and non-rated door, cut from corner of door, showing door construction.
2. 12 inch x 12 inch sample of each type of door louver specified or required, showing louver construction.
3. 6 inch long sample of a fire-rated, non-rated frame, and each type of glass stop specified or required, showing corner and construction.

D. Certificates:
   1. Manufacturer's certification that oversized openings are in compliance with specifications.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: If other than a manufacturer listed under Paragraph 2.1 is proposed for use on the Project, it shall be a company specializing in the manufacturer of steel doors and frames of the type specified for this Project with a minimum of five (5) years experience.

B. All steel doors and frames shall be by a single manufacturer, shop drawings to be submitted with manufacturer's insignia which is being supplied.

C. Furnish steel doors and frames to meet current ANSI/Steel Door Standards.

D. ANSI/SDI-A250.13 (2003) Testing and Rating of Sever Windstorm Resistant Components for Swing Door Assemblies.

E. ASTM E 330-97, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

F. Comply with ASTM E 283 – Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

1.7 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies:
   1. Fire-Rated Door, Panel, Frame, and Fire Window Construction: Shall conform to ASTM E2074, NFPA 252, or UL 10B, as applicable, and acceptable to the code authorities having jurisdiction.
   2. Fire-Rated Door Construction:
      a. Not withstanding any other requirements of this Specification, provide gauge of metal, method of construction, hardware preparation, reinforcement, and placement, glass opening size, and other specifics required to obtain the specified or required label. The label shall contain the fire resistance rating (20 minute, 45 minute, 1 hour, 1-1/2 hour, 3 hour, etc.) and the designation (A, B, C, D, or E). Doors with "B" Label shall be 1-1/2 hour.
      b. Fire-rated doors used in a stairway enclosure, shall be so constructed so that the maximum transmitted temperature shall not exceed 450 degrees F above ambient temperature at the end of 30 minutes of the Standard Fire Exposure Test and shall be so noted on the label.

   3. Fire-Rated Openings: Conform to NFPA 80 for fire-rated class shown or required by code authorities having jurisdiction.
      a. Units shall be identical to assemblies whose fire resistance characteristics have been determined in accordance with requirements specified under Paragraph C, 01, above, and shall be labeled and listed by UL, WHI, or other inspection and testing agency acceptable to the code authorities having jurisdiction.
      b. Fire-rated steel doors, panels, frames, and fire windows shall bear permanent labels attesting to fire resistance. At stairway enclosures, provide units listed for 450 degree F maximum temperature rise rating for 30 minutes of exposure.
      c. Oversized openings shall be constructed in accordance with all applicable requirements for labeled door construction.

d. Fire rated door assemblies with gaps in excess of 1/8 inch between door and frame will not comply with NFPA 80.
e. Locate label on hinge side of doors and frames so that when door is closed, label is not visible.
f. Caution shall be taken to ensure that labels are not removed, damaged or painted over.
g. Glass panes shall not exceed sizes allowed whether indicated or not on the drawings.

B. Wind Loads: Provide hollow metal and door hardware assemblies approved by the Texas Department of Insurance, including anchorage, capable of withstanding windload design pressures which are calculated for this project by a registered Architect or Engineer and is part of the construction documents per the Texas Department of Insurance, authorities having jurisdiction and the International Building Code Design Loads per section 1609.

C. Hurricane-Resistance Test Performance: Provide hollow metal and door hardware approved assemblies that pass large missile-impact tests, as required by Texas Department of Insurance systems location above grade, and cyclic-pressure tests according to testing requirements of authorities having jurisdiction.
1. Impact Resistance: Hollow metal with approved door hardware assemblies must satisfy the Texas Department of Insurance's criteria for protection from windborne debris in both the Inland 1 zone and the Seaward zone. The assemblies must have passed the large missile impact test (which equates to Missile Level D specified in ASTM E 1996-02). The assemblies may be installed at any height on the structure as long as the design pressure rating for the assemblies is not exceeded. These assemblies will and do not need to be protected with an impact protective system when installed in areas where windborne debris protection is required.

1.8 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 – Project Management and Coordination.

1.9 COORDINATION

A. Coordinate the Work of this Section with Work in which hollow metal Work is installed.

B. Coordinate hardware installation with opening construction. Finish hardware is specified in Section 08 71 00.

C. Coordinate doors, frames, and windows with glazing specified in Section 08 80 00.

D. Coordinate doors and frames with painting specified in Section 09 91 00.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products in accordance with manufacturer's instructions, and as follows:
1. In manufacturer's original, clearly labeled, undamaged containers or wrappers.
2. Containers or wrappers shall list the name of the manufacturer and product.

B. Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. Protect products from moisture, construction traffic, and damage.
1. Store under cover in a clean, dry place, protected from weather and abuse.

2. Store in a manner that will prevent rust or damage.
3. Store doors in a vertical position, spaced with blocking to permit air circulation.
4. Do not use non-vented plastic or canvas shelters.
5. Should containers or wrappers become wet, remove immediately.

1.11 WARRANTY

A. Warrant the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.

B. Defects shall include, but not be limited to:
1. Use of incorrect materials in opening
2. Incorrect labeled components installed within opening.
3. Noisy, rough or difficult operation
4. Failure to meet specified quality assurance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed below whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must comply with Paragraph 1.5, A, Manufacturer Qualifications, must manufacture equivalent products to those specified and comply with requirements of Division 1 regarding substitutions to be considered.
1. CECO Door Products, an Assa Abloy company. (888-264-7474).
2. Curries Company, an Assa Abloy company. (641-423-1334).
3. Deansteel Mfg. Co.; (210) 226-8271.
4. Door Pro Systems, Inc., (713) 462-0860.
5. Mesker Door Inc.; (256) 851-6670.
6. Pearland Industries; (713) 434-9898.
7. Pioneer Industries, Inc.; (309) 856-6000.
8. Republic Builders Products Company; (800) 733-3667.
9. Steelcraft Mfg. Co., an Assa Abloy company; (513) 745-6400.

2.2 MATERIALS, GENERAL

A. Steel requirements, all frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM-A1008 general requirements. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A1011. Exterior frames and interior frames where shown on drawings or required in damp, moist, humid, and wet areas, i.e., toilets, locker rooms, showers, etc., to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel and galvannealed to 'A-60' minimum coating weight standard per ASTM-A653 and A924, with coating weight of not less than 0.60 ounce per square foot (0.30 ounce per square foot per side).

2.3 FRAME FABRICATION

A. Minimum Gauges:
1. Interior Openings:
a. Less than 4 feet-0 inches in Width: 16 gauge.
b. 4 feet-0 inches in Width and greater: 14 gauge.

2. Exterior Openings: 14 gauge

B. Design and Construction:
1. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings. Hinge jambs that butt adjacent 90 degree walls shall have at least four (4) inch wide frame face to assure the door trim will not strike the wall prior to the door opening at least 90 degrees. Frame profile shall match wall thickness where practical, i.e., 4-3/4 inch at 4 inch CMU, 6-3/4 inch at 6 inch CMU, and 8-3/4 inch at 8 inch CMU. At masonry wall openings, fabricate frames to suite masonry opening with 2 inch head member.
2. Frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Molded members shall be clean cut, straight and of uniform profile throughout their length.
3. Jamb depths, trim, profile and backbends shall be as shown on approved shop drawings.
4. Corner joints, including face and inside corners, shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted. Face of frame shall be ground smooth. Knockdown (KD) frames are not permitted.
5. Minimum depth of stops shall be 5/8 inch, except at fire windows where minimum depth of stops shall be 3/4 inch.
6. Frames for multiple openings shall have mullion and rail members which are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Mullions shall be key locked removable type. Keys shall be master keyed to Owner's Best system.
7. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
8. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Division 8 Door Hardware.
9. Provide countersunk flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at exterior locations.
10. Provide A60 Galvannealed coating at frames in restrooms and locker rooms with showers/Jacuzzi, clean areas such as kitchen rooms.
11. Electrical Knock Out Boxes: Factory weld 18 gage electrical knock out boxes to frame for electrical hardware preps; included but not limited to electric thru wire hinges, electrical raceways, door position switches, electric strikes, jamb mount card readers, and magnetic licks as noted in door hardware sets in Division 8 Finish Hardware.
    a. Electrical knock out boxes are required at door position switches, electric strikes, card readers, and middle hinge locations for all exterior locations regardless of electrical hardware specified in Division 8 Finish Hardware.
    b. Provide electrical knock out boxes with ¾-inch knockouts.
    c. Conduit to be coordinated and installed in field from middle hinge box and strike box to door position box.
    d. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 8 Finish Hardware.
    e. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
    f. Provide field installed conduit per Division 28 section for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 8 Finish Hardware. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.

12. Hardware Reinforcements:
    a. Frames shall be mortised, reinforced, drilled and tapped at factory for fully template mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 71 00. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
    b. Minimum thickness of hardware reinforcing plates shall be as follows:
        1) Hinge and pivot reinforcements (1-1/4 inch x 10 inch minimum size): 7 gauge.
        2) Strike reinforcements: 12 gauge.
        3) Flush bolt reinforcements: 12 gauge.
        4) Closer reinforcements: 12 gauge.
        5) Reinforcements for surface-mounted hardware, hold-open arms, surface panic devices: 12 gauge.

13. Floor Anchors: Minimum 14 gauge, securely welded inside each jamb, with holes for floor anchorage.
14. Jamb Anchors:
    a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-Strap type. Anchors shall be not less than 16 gauge steel. The number of anchors provided at each jamb shall be as follows:
        1) Frames up to 7 feet-6 inch height - Three (3) anchors
        2) Frames 7 feet-6 inch to 8 feet-0 inch height - Four (4) anchors
        3) Frames over 8 feet-0 inch height - One (1) anchor for each 2 feet or fraction thereof in height.

    b. Frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16 gauge thickness, securely welded inside each jamb as follows:
        1) Frames up to 7 feet-6 inch height - Four (4) anchors
        2) Frames 7 feet-6 inch to 8 feet-0 inch height - Five (5) anchors
        3) Frames over 8 feet-0 inch height - Four (4) anchors plus one (1) additional for each 2 feet or fraction thereof over 8 feet-0 inches.

    c. Frames to be anchored to previously placed concrete, masonry or structural steel shall be provided with anchors of suitable design as shown on approved shop drawings.

15. Dust Cover Boxes: Shall be of not less than 26 gauge steel and shall be provided at all mortised hardware items. Eight (8) inch CMU walls with face brick shall have dual offset jamb anchors.
16. Steel Spreader: Shall be provided on all frames, temporarily attached to bottoms of both jambs for bracing during shipping and handling.
17. Loose Glazing Stops: Shall be of cold rolled steel, not less than 20 gauge, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws. Loose stops at exterior frames shall be placed on the interior side of the frames.
18. At sound rated door openings and at masonry openings, coat inside of frame profile with corrosion resistant coating to minimum thickness of 1/16 inch.

C. Frame Color: Field painted under Section 09 90 00 to match face of door.

2.4 DOOR FABRICATION

A. Minimum Gauges:
    1. Interior

2. Doors: 0.047 inch or 18 gauge (16 gauge for high frequency doors).
2. Exterior Doors: 0.059 inch or 16 gauge (14 gauge for windstorm rated doors).

B. Design and Construction:
1. Types: Doors shall be custom fabricated, of types and sizes shown on approved shop drawings, and shall be seamless face construction with no visible seams or joints on vertical edges with fully welded seams free from blemishes and defects.Thickness: Shall be 1-3/4 inch, unless specifically noted or shown otherwise.
2. Exterior Doors: Provide doors with 22 gage steel z-channels placed at 6 inches apart with foamed in place polyurethane core, with a thermal insulation calculated R factor of 11.01 per ASTM C518 Standards.
3. Fabrication:
   a. Doors shall be strong, rigid and neat in appearance, free from warpage and buckle.
   b. Corner bends shall be true and straight and of minimum radius for gage of metal used.
   c. Provide 22 gauge steel stiffeners spaced maximum six (6) inches on center and extending full height of door.
   d. Fill interior with noncombustible fiberglass insulation. Use mineral board filler as required for labeled doors.
   e. Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to provide a smooth flush surface.
   f. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot weld to both faces. Exterior doors shall have an additional flush closing channel at top and bottom edges. Openings shall be provided in the bottom closure channel at top and bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.
   g. Continuous Hinge Reinforcement: Provide welded continuous 12 gage strap for continuous hinges specified in hardware sets in Division 8 Finish Hardware.
   h. Electrical Raceways: Provide raceways for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 8 Finish Hardware. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.
   i. Doors within in wet or humid areas shall have a top cap and solid foam interior core to prevent internal moisture accumulation and galvannealed.
   j. Edge profile shall be provided on both vertical edges of door as follows:
      1) Single-Acting Swing Doors: Beveled 1/8 inch in 2 inches.

   k. Hardware Reinforcements:
      1) Doors shall be mortised, reinforced, drilled and tapped at factory for fully template hardware, in accordance with the approved hardware schedule and templates provided by Section 08 71 00. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only.
      2) Minimum gauges for hardware reinforcing plates shall be as follows:
         a) Hinge & pivot reinforcements: 7 gauge
         b) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.

4. Glass Moldings and Stops: Loose stops shall be not less than 20 gauge steel, with butt corner joints, secured to frame opening by countersunk screws. Snap-on attachments will not be acceptable.
5. Edge Clearances:

a. Between Door and Frame at Head and Jambs: 1/8 inch.
b. At DoorSills with No Threshold: 5/8 inch to 3/4 inch above finished floor.
c. At DoorSills with Threshold: As required to suit threshold.
d. Between Meeting Edges of Double Doors: 1/8 inch.

C. Finish:
1. Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
a. Clean surfaces free of mill scale, rust, oil, grease, dirt and other foreign matter.
b. Chemically treat surfaces and apply one (1) coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.

2. Field painted under Section 09 90 00.

2.5 LABELED DOORS AND FRAMES

A. Labeled doors and frames shall be provided for openings requiring fire protection ratings as scheduled and to comply with NFPA 80. Such doors and frames shall be constructed as tested and approved by UL, WHI, or other nationally recognized testing agency having a factory inspection service and approved by code authorities having jurisdiction and shall bear the appropriate permanent label.

B. If any door or frame scheduled to be fire-rated cannot qualify for appropriate labeling because of its size, design, hardware or other reason; the Architect shall be so advised before fabrication work on that item is started.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Separate dissimilar metals. Protect against galvanic action.

B. Frames:
1. Anchorage and Connections: Secure to adjacent construction. Where practical, interior door frames shall be flush with the pull side wall to minimize or eliminate the reveal and allow full 180 degree door swing.
2. Install frames in accordance with manufacturer’s instructions and install labeled frames in accordance with NFPA 80.
3. Frame Spreader Bars: Leave intact until frames are set perfectly square and plumb and anchors are securely attached.
4. Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint Work is completed. Do not remove or paint over labels on labeled frames.

C. Doors:
1. Install hardware in accordance with hardware manufacturer's templates and instructions.
2. Install doors in accordance with manufacturer’s instructions and install labeled doors in accordance with NFPA 80.
3. Adjust operable parts for correct function.
4. Remove hardware, with the exception of prime-coated items, tag, box, and reinstall after finish paint Work is completed. Do not remove or paint over labels on labeled doors.

3.2 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces.

C. Remove scraps and debris, and leave site in clean condition.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. WI Certified, fire-rated and non-rated, flush panel wood doors.
   2. Solid core doors with MDF and plastic laminate faces.
   3. Integration of a security system.
   4. Factory fitting flush wood doors to frames and factory machining for hardware.
   5. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications.
   2. Section 07 92 00 - Joint Sealants.
   3. Section 08 11 13 - Hollow Metal Doors and Frames.
   4. Section 08 80 00 - Glazing.
   5. Section 09 21 16 - Gypsum Board Assemblies.
   6. Section 09 24 00 - Cement Plastering.

1.3 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

C. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.

D. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

F. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data:
   1. Technical data for each type of door indicated:
      a. Include details of core and edge construction, louvers, and trim for openings.
      b. Include factory finishing specifications.
      c. Include laboratory test report results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.

B. Shop Drawings:
   1. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
      a. Dimensions and locations of blocking.
      b. Dimensions and locations of mortises and holes for hardware.
      c. Dimensions and locations of cutouts.
      d. Undercuts.
      e. Requirements for veneer matching.
      f. Doors to be factory finished and finish requirements.
      g. Fire-protection ratings for fire rated doors.

C. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for fire rated door assemblies and smoke and draft control door assemblies.

D. Certificate of Compliance regarding WI construction grade.

E. Certificate of Compliance regarding WI installation requirements.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire rated wood doors - NFPA 80 listed and labeled by UL for fire protection ratings indicated, based on testing at positive pressure according to UL 10C:
      a. Oversize fire rated door assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
      b. Temperature rise limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 degrees F (250 degrees C) above ambient after 30 minutes of standard fire-test exposure.
   2. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
   3. Accessibility requirements - comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2016 ADA Standards for Accessible Design.
   4. Quality standard: In addition to requirements specified, comply with Woodwork Institute WI Manual of Millwork
   5. Maintain at least one copy of WI Manual for reference at jobsite throughout installation period.

B. Source Limitations: Obtain flush wood doors through one (1) source from a single manufacturer.

C. Pre-Installation Conference: Conduct conference at site.

1.6 WARRANTY

A. Warranty:
   1. Written warranty signed by manufacturer, installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship. A representative of the door manufacturer shall inspect the installed doors and shall note on the warranty that no provisions of the warranty have been nullified in the manufacture and/or installation:
      a. Failures include, but are not limited to, the following:
         1) Warping (bow, cup, or twist) more than 1/4-inch (6.4 mm) in a 42-inch by 84-inch (1,067 mm by 2,134 mm) section.
         2) Telegraphing of core construction in face veneers exceeding 0.01-inch in a three-inch (0.25 mm in a 76.2 mm) span.
      b. Warranty include installation and finishing that may be required due to repair or replacement of defective doors.
      c. Warranty period for solid core exterior doors: Five (5) years from date of Substantial Completion.
      d. Warranty period for solid core interior doors: Life of installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store wood doors on a flat level surface in a dry, well ventilated, place. Keep wood doors a minimum of 3-1/2 inches (85 mm) off floor surface and protected by a protective covering under the bottom door and over the top door. Covering should protect wood doors from dirt, water, and abuse but allow for air circulation under and around the stack. Do not store wood doors in direct sunlight. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in heavy duty cardboard cartons prior to shipment from factory. Mark each door on top and bottom rail with opening number used on shop drawings using temporary, removable, or concealed markings.

C. Handle wood doors with clean gloves. Lift and carry wood doors when moving them around the site; do not drag wood doors across one another.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Flush Wood Doors:
      a. Haley Brothers, Inc.
      b. Oshkosh Door Company.
      c. Oregon Door.
      d. Weyerhaeuser.
   2. High Pressure Laminate:
      a. Formica Corp.
      b. Panolam Surface Systems.
      c. Wilsonart LLC.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 MATERIALS

A. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Cores: Provide core specified or mineral core as necessary to provide fire protection rating indicated.
   2. Edge construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
   3. Pairs: Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
   4. Pairs:
      a. Provide formed steel edges and astragals with intumescent seals:
         1) Finish steel edges and astragals with baked enamel same color as doors.
         2) Finish steel edges and astragals to match door hardware (locksets or exit devices).

B. Smoke and Draft Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

C. Particleboard Core Doors:
   1. Blocking:
      a. Provide wood blocking in particleboard core doors as necessary to eliminate through-bolting hardware:
         1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
         2) Five-inch (125 mm) bottom rail blocking, in exterior doors and doors indicated to have protection plates.
         3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
         4) 4-1/2 inch by 10 inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.

2. Provide doors with glued wood stave or structural composite lumber cores instead of particleboard cores for doors indicated to receive exit devices.

D. Fire Rated Wood Doors with Plastic Laminate Face - Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C:
   1. Core: Noncombustible mineral product complying with requirements and testing and inspecting agency for fire protection rating indicated.
   2. Blocking:
      a. Provide composite blocking with improved screw-holding capability approved for use in doors of fire protection ratings indicated as follows:
         1) 5 inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
         2) 5 inch (125 mm))bottom rail blocking, in doors indicated to have protection plates.
         3) 5 inch ((125 mm))midrail blocking, in doors indicated to have exit devices.
         4) 4-1/2 inch by 10 inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.
   3. Edge Construction:
      a. Provide fire rated door edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges:
         1) At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance:
            (a) Screw holding capability: 550 lbf (2440 N) per WDMA T.M.-10.
         2) Pairs:
            (a) Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges. Where required, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.
   4. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

2.3 PLASTIC-LAMINATE-FACED DOORS

A. Particleboard Core Doors with Plastic Laminate Face:
   1. Grade and construction: WI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
   2. Core - ANSI A208.1 , particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
   3. Blocking:
      a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
         1) Five-inch (125 mm) top rail blocking. in all doors, whether or not closers are scheduled.
         2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
         3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
         4) 4-1/2-inch by ten-inch ((114 mm by 250 mm)) lock blocks, in doors indicated with lock and latch sets.
   4. Construction: Five (5) plies. Bond stiles and rails to core, then abrasive plane entire unit before faces and crossbands are applied. Bond faces to core using a hot press.
   5. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
   6. Face: 3-ply AWI PC-HPDL-3 High Pressure Decorative Laminate (HPDL).
      a. Finish: PL-1.

b. Edge: Factory painted to match door face.

2.4 PAINTED DOORS (OPAQUE FINISH)

A. Particleboard Core Doors with Painted Finish:
1. Grade and construction: AWI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
2. Core - ANSI A208.1, particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
3. Blocking:
a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2-inch by ten-inch ((114 mm by 250 mm)) lock blocks, in doors indicated with lock and latch sets.
4. Exposed Vertical and Horizontal Edges:
a. Material: Plastic laminate.
1) Plastic Laminate: Match face.
5. Exposed vertical and horizontal edges:
a. Seal all exposed edges with primer and provide opaque finish.
b. Color: Match face color and finish unless noted otherwise.
c. Labels: Mask labels prior to field painting where doors are not delivered with factory finish.
6. Construction: Five (5) plies. Bond stiles and rails to core, then abrasive plane entire unit before faces and crossbands are applied. Bond faces to core using a hot press.
7. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
8. Face: Paint grade medium density overlay (MDO).

2.5 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings: Manufacturer’s standard frame formed of 0.048 inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048 inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint with baked-enamel or powder-coated finish, and approved for use in doors of fire-protection rating indicated.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated:
1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, BHMA-156.115-W, and hardware templates:
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:
1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles:

a. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings:
1. Factory cut and trim openings through doors:
a. Light openings: Trim openings with moldings of material and profile indicated.
b. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00: Glazing.
c. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors:
1. Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming or factory finishing:
a. Flash top of out-swinging doors with manufacturer's standard metal flashing.

2.7 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one (1) coat of wood primer specified in Section 09 90 00: Painting and Coating.

B. Doors for Transparent Finish: Shop prime faces and all four edges with stain (if required), other required pretreatments, and first coat of finish as specified in Section 09 90 00: Painting and Coating. Seal edges of cutouts and mortises with first coat of finish.

2.8 FACTORY FINISHING

A. General – For factory finish doors, factory finish doors that are indicated to receive transparent finish, and factory finish doors where indicated in schedules or on Drawings as factory finished:
a. Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing:
1) Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish:
1. Grade: Premium.
2. Finish: WI's Architectural Woodwork Standards System 9, UV curable, acrylated epoxy, polyester, or urethane; refer to Drawings for finish designation.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Semigloss.

C. Opaque Finish:
1. Grade: Premium.
2. Finish: AWMAC's and WI's Architectural Woodwork Standards System 10, UV curable, water based; refer to Drawings for finish designation.
3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Semigloss.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

3.2 EXAMINATION

A. Examine doors and installed door frames, with installer present, before hanging doors:

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Hardware: For installation, see Section 08 71 00: Door Hardware.

B. Installation Instructions:
1. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated:
a. Install fire-rated doors according to NFPA 80.
b. Install smoke and draft-control doors according to NFPA 105.

C. Job-Fitted Doors:
1. Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining:
a. Clearances:
1) Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated:
(a) Comply with NFPA 80 for fire-rated doors.
b. Bevel non-fire-rated doors 1/8 inch in two inches (2”) - 3-1/2 degrees - at lock and hinge edges.
c. Bevel fire-rated doors 1/8 inch in 2 inches - 3-1/2 degrees- at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

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SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Access doors in gypsum board and plaster/stucco soffits, where shown or required.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature, including schedules, charts, and illustrations to indicate the performance, fabrication, procedures, product variations, and accessories.
   2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing access doors meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions in order to be considered.
   1. The Bilco Company, (
   2. Acudor Products, Inc., Cedar Grove, NJ.
   3. Babcock-Davis (Cierra Products), Garland, TX.
   4. Bar-co, Alfab, Inc., Enterprise, AL.
   5. J. L. Industries, Incorporated, Bloomington, MN.
   6. Karp Associates, Inc., Maspeth, NY.
   7. Larsen's Manufacturing Company, Minneapolis, MN.
   8. Milcor LP, Holland, OH.
   9. Nystrom Building Products Co. Inc., Minneapolis, MN.
   10. The Williams Brothers Corporation of America, Front Royal, VA.

B. Specifications are based on products of Babcock-Davis, Garland, TX; (888) 412-3726.

2.2 PRODUCTS

A. General: The following access panel types are for selection as required whether or not indicated on drawings. The contractor shall evaluate the specific requirements and provide the appropriate system based on the condition, as all types may not be required on the project. The inclusion of any of the listed access panel types does not necessarily imply that the condition exists in the scope of work.

B. Standard type flush steel door for wallboard and masonry construction:
   1. Size: 2 feet-0 inches x 2 feet-0 inches unless otherwise noted in drawings or specifications.

a. Provide 12 inch x 12 inch access panels at all motorized overhead coiling doors, grilles, and coiling counter doors that are located within non-removable ceilings for access to motors for repairs and maintenance of electric operators.

2. Hinges: Concealed continuous piano type hinges.
3. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00.
4. Frames: 16 gauge galvanized steel with 22 gauge galvanized wallboard corner bead
5. Doors: 14 gauge galvanized steel.
6. Lock: Flush screw driver operated cam.
7. Approved Product: Model “B-NW”, or Architect approved equal.

C. Standard type flush stainless steel door for ceramic tile and exposed masonry construction:
1. Size: 8 inch x 8 inch unless otherwise noted in drawings or specifications.
2. Hinges: Concealed spring button.
3. Finish: #4 satin polish.
4. Frames: 16 gauge type 304 stainless steel with 1 inch exposed flange.
5. Doors: 16 gauge type 304 stainless steel.
6. Lock: Key operated cam latch.
7. Approved Product: Model “BNT”, or Architect approved equal.

D. Standard type flush steel door for plaster/stucco soffit construction:
1. Size: As shown on the drawings.
2. Hinges: Concealed continuous piano type hinges.
3. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00.
4. Frames: 16 gauge galvanized steel with 22 gauge galvanized plaster casing bead
5. Doors: 14 gauge galvanized steel.
6. Lock: Flush screw driver operated cam.
7. Approved Product: Model “B-NP”, or Architect approved equal.

E. Fire rated flush steel door for wallboard construction:
1. Listing: UL listed ‘B’ label up to 1-1/2 hours in walls and Warnock-Hershey listed up to 3 hours in ceilings.
2. Size: As shown on the drawings.
3. Hinges: Concealed pin hinge
4. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00.
5. Frames: 16 gauge galvanized steel with 22 gauge galvanized wallboard corner bead
6. Doors: 20 gauge galvanized steel.
7. Lock: Knurled knob/key operated latch bolt.
8. Insulation: 2 inch thick fire rated mineral fiber
9. Approved Product: Model “B-IW”, or Architect approved equal.

F. Insulated access panel for valve box in exterior brick wall:
1. Size: 12 inches x 12 inches, or as required for application.
2. Door: 0.060 6063-T5 extruded aluminum.
3. Frame: 0.060 6063-T5 extruded aluminum.
4. Hinge: Stainless steel concealed piano hinge.
5. Latch: Hex head cam latch operable with standard allen wrench.
6. Flange: 0.080 6063-T5 extruded aluminum.
7. Finish: Paint grip.
8. Insulation: Two (2) inch thick fiberglass.
9. Gasket: Extruded Sanoprene.
10. Approved Product: Model “B-XT”, or Architect approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and provide panels to the trade that is constructing the material being penetrated.

3.2 LOCATIONS

A. Provide where required by code and where needed to service and maintain equipment.

B. If not shown on the drawings, consult the Architect before locating in finished spaces.

END OF SECTION 08 31 13

SECTION 08 33 13 - COILING COUNTER DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Electric operated coiling counter doors

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications.
   2. Section 06 10 00 - Rough Carpentry.
   3. Section 08 71 00 - Door Hardware.
   4. Section 09 90 00 - Painting and Coating.
   5. Division 26 - Electrical.

1.3 SUBMITTALS

A. Reference Section01 33 00 - Submittal Procedures; submit the following items:
   1. Product Data
   2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
   3. Quality Assurance/Control Submittals:
      a. Provide manufacturer ISO 9001 registration.
      b. Provide manufacturer and installer qualifications - see below.
      c. Provide manufacturer's installation instructions.
   4. Closeout Submittals:
      a. Operation and Maintenance Manual.
      b. Certificate stating that installed materials comply with this specification.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: ISO 9001 registered and a minimum of five years experience in producing counter doors of the type specified.
   2. Installer Qualifications: Manufacturer’s approval.

1.5 DELIVERY STORAGE AND HANDLING

A. Refer to Section 01 60 00 - Product Requirements.

B. Follow manufacturer’s instructions.

1.6 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship

B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturers listed who produce equivalent products to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years’ experience manufacturing equivalent products to those specified and comply with Division 01 requirements regarding substitutions to be considered and approved by Architect:
   1. CornellCookson, LLC.
   2. Substitutions: Not permitted.

B. Product Information:
   1. Basis of Design: Model ESC10 as manufactured by CornellCookson, LLC.

2.2 MATERIALS

A. Curtain:
   1. Slat Configuration:
      a. Galvanized Steel with Finish No. 1F: Interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 22 gauge ASTM A653/A653M, Commercial Quality, galvanized steel with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal
   2. Finish:
      a. Material: Cornell SpectraShield® Coating System.

B. Endlocks:
   1. Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats

C. Guides:
   1. Fabrication:
      a. Aluminum: Heavy duty extruded aluminum sections with Snap-on cover to conceal fasteners. Provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain.
   2. Finish:
      a. Material: Powder coat.
      b. Color: As selected by Architect.

D. Tube Motor Shaft Assembly:
   1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width

E. Brackets:
   1. Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures
      a. Finish:
         1) Material: Cornell SpectraShield® Coating System.
         2) Color: As selected by Architect.

F. Hood:
   1. Minimum 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets.
      a. Finish:
         1) Material: Cornell SpectraShield® Coating System.
         2) Color: As selected by Architect).

2.3 OPERATION

A. Electric Tube Motor Operator:
   1. Rated for a maximum of 10 cycles per day, cULus recognized, rated (50 nm) (100 nm) or (200 nm) as recommended by door manufacturer for size and type of door, 110 Volts, 1 Phase.
   2. Provide complete with electric tube motor, maintenance free electric brake, emergency manual crank hoist and control station(s). Motor shall be protected against overload with an auto-reset thermal sensing device.
   3. Operator shall be equipped with an emergency manual crank hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual crank hoist.
   4. Operator shall be capable of 10-14 RPM. Fully adjustable, mechanical internal worm limit switch mechanism shall synchronize the operator with the door.

5. Electrical Contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

B. Control Station: For use with motor operated units only.
   1. Flush mounted: "Open/Close" key switch with BEST cylinder.

C. Control Operation:
   1. Constant pressure to close:
      a. 2-wire, electric sensing edge seal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a wireless edge connection to control circuit.

2.4 ACCESSORIES

A. Locking:
   1. Master Key Cylinder Lock to Owner Standards:
      a. Operable from coil side of bottom bar. Provide Interlock switches on motor operated units.
      b. BEST 7-Pin

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates

C. Commencement of work by installer is acceptance of substrate

3.2 INSTALLATION

A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports

B. Follow manufacturer's installation instructions

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer

B. Remove surplus materials and debris from the site

3.5 DEMONSTRATION

A. Demonstrate proper operation to Owner's Designated Representative.

B. Instruct Owner's Designated Representative in maintenance procedures

END OF SECTION 08 33 13

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SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Service doors.
   2. Accessories necessary for a complete installation.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, licensed in the State of Texas, using performance requirements and design criteria indicated.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: Indicated on Drawings.
   2. Testing: According to ASTM E 330.
   3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
   4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. (5.1 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E 283].

D. STC Rating: 26.

E. Curtain R-Value: 5.0 degrees F x h x sq. ft./Btu (0.881 K x sq. m/W).

F. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than 100,000 cycles for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
   1. Include tamperproof cycle counter.

1.4 SUBMITTALS

A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   2. Include description of automatic closing device and testing and resetting instructions.

B. Shop Drawings: Submit plans, elevations, sections, and mounting details.
   1. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   5. Show locations of controls, locking devices [, detectors or replaceable fusible links], and other accessories.
   6. Include diagrams for power, signal, and control wiring.

C. Samples: Submit samples for exposed metal finish in standard sizes.

D. Delegated Design Submittal: Submit delegated design including analysis data signed and sealed by the professional engineer licensed in the State of Texas who is responsible for the preparation.

E. Oversize Construction Certification: For door assemblies required to be fire rated and that exceed size limitations of labeled assemblies.

F. Maintenance Data: Submit for inclusion in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.
      a. Smoke Control: Where indicated, provide doors that are listed and labeled with the letter "S" on the fire rating label by a qualified testing agency for smoke and draft control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of door opening at 0.10 inch wg (24.9 Pa) for both ambient and elevated temperature tests.
   2. Sound Control Doors: Assemblies tested in a laboratory for sound transmission loss performance according to ASTM E 90, calculated according to ASTM E 413, and rated for not less than the STC value indicated.
   3. Accessibility Requirements: Comply with applicable requirements.
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS).

B. Installer Qualifications: Entity having minimum 5 years documented experience who employs installers and supervisors trained and approved by manufacturer for both installation and maintenance of units required.

C. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

1.6 WARRANTY

A. Warrant the work specified herein for two (2) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

PART 2 PRODUCTS

2.1 DOOR ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Clopay Building Products.
   2. Cookson Company.
   3. Cornell Iron Works, Inc.
   4. McKeon Door Company, Inc. as distributed by Griesenbeck.
   5. Overhead Door Corporation.
   6. Wayne-Dalton Corp.
   7. Holiday Gate & Door Systems Inc.

B. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

C. Overhead Coiling Door (OD-1) Basis of Design: ESD10 as manufactured by Cornell Cookson.
   Operation: Motorized.

D. Overhead Coiling Door - Sound Rated: Basis of Design: Thermiser ESD20 as manufactued by Cornell Cookson

1. Stc: 30.
2. Operation: Motorized.

E. Overhead Coiling Grille (OD-3): Basis of Design: Visionaire Model ESG10 as manufactured by Cornell Cookson.
   Operation: Motorized.
   Rods to be spaced at 6 inches apart.

F. Door Curtain Slats: Flat profile slats of 2-5/8 inch (67 mm) center to center height.
   1. Vision Panels: Approximately 10 inch by 1-5/8 inch (254 mm by 41 mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in three rows of slats at height indicated on Drawings; installed with vision panel glazing.
   2. Gasket Seal. Continuous gaskets between slats.

G. Bottom Bar: Two angles, each not less than 1-1/2 inch by 1-1/2 inch by 1/8 inch (38 mm by 38 mm by 3 mm) thick; fabricated from hot dip galvanized steel and finished to match door.

H. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats.

I. Hood: Match curtain material and finish.
   1. Shape: Round.
   2. Mounting: Between jambs.

J. Locking Devices: Equip door with locking device assembly.
   1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.

K. Manual Door Operator: Chain hoist operator.
   1. Provide operator with through wall shaft operation.
   2. Provide operator with removable operating arm.

L. Curtain Accessories: Equip door with weatherseals, astragal, push/pull handles, pull down strap, and poll hook.

M. Door Finish:
   1. Baked Enamel or Powder Coated Finish: Selected by Architect.
   2. Factory Prime Finish: Factory Prime Finish: Selected by Architect.
   3. Interior Curtain Slat Facing: Match finish of exterior curtain slat face.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc coated (galvanized), cold rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.
   2. Vision Panel Glazing: Clear glazing, fabricated from transparent acrylic sheet or fire protection rated glass as required for type of door; set in glazing channel secured to curtain slats.
   3. Metal Interior Curtain Slat Facing: Match metal of exterior curtain slat face, with minimum aluminum thickness of 0.032 inch (0.80 mm).

B. Curtain Jamb Guides: Angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.3 HOODS

A. Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface mounted hoods and fascia for any portion of between jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Galvanized Steel: Nominal 0.028 inch (0.71 mm) thick, hot dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
   2. Include automatic drop baffle on fire rated doors to guard against passage of smoke or flame.
   3. Exterior Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant joint bead profile for applying joint sealant.

2.4 LOCKING DEVICES

A. Slide Bolt: Fabricate with side locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   1. Lock Cylinders: Refer to Section 08 71 00.
   2. Keys: Refer to Section 08 71 00.

C. Chain Lock Keeper: Suitable for padlock.

D. Safety Interlock Switch: Equip power operated doors with safety interlock switch to disengage power supply when door is locked.

2.5 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather stripping gaskets fitted to entire exterior perimeter of door for weather resistant installation unless otherwise indicated.
   1. At door head, use 1/8 inch (3 mm) thick, replaceable, continuous sheet baffle secured to inside of hood or field installed on the header.
   2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8 inch (3 mm) thick seals of flexible vinyl, rubber, or neoprene.

B. Astragal for Interior Doors: Equip each door bottom bar with replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

C. Push/Pull Handles: Equip each push up operated or emergency operated door with lifting handles on each side of door, finished to match door.

D. Pull Down Strap: Provide pull down straps for doors more than 84 inches (2130 mm) high.

E. Poll Hooks: Provide pole hooks and poles for doors more than 84 inches (2130 mm) high.

2.6 COUNTERBALANCING MECHANISM

A. Counterbalance doors using standard mechanism with adjustable tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot formed, structural quality, seamless or welded carbon steel pipe, of sufficient diameter and wall thickness to support rolled up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Counterbalance Spring: One or more oil tempered, heat treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast steel barrel plugs.
   1. Fire Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.

D. Torsion Rod for Counterbalance Shaft: Fabricate of cold rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Mounting brackets fabricated from either cast iron or cold rolled steel plate.

2.7 MANUAL DOOR OPERATORS

A. Equip door with manual door operator by door manufacturer.

B. Push up Door Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).

C. Chain Hoist Operator: Consisting of endless steel hand chain, chain pocket wheel and guard, and gear reduction unit with a maximum 25-lbf (111-N) force for door operation. Provide alloy steel hand chain with chain holder secured to operator guide.

2.8 FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA Metal Finishes Manual for Architectural and Metal Products (AMP 500-06) for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel and Galvanized Steel Finishes:
   1. Factory Prime Finish: Standard primer, compatible with field applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
   2. Baked Enamel or Powder Coat Finish: Baked on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
   3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so doors operate easily, free of warp, twist, or distortion. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23

SECTION 08 33 26 - OVERHEAD COILING GRILLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Open curtain overhead coiling grilles.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each type and size of overhead coiling grille and accessory, including construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: Submit for each installation and for special components not dimensioned or detailed in manufacturer's product data, plans, elevations, sections, and mounting details.
   1. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   3. For exterior components, include details of provisions for assembly expansion and contraction.
   4. Show locations of controls, locking devices, and other accessories.
   5. Include diagrams for power, signal, and control wiring.

C. Samples: Submit samples for each type of exposed finish on the following components, in standard sizes:
   1. Open curtain grille with full size components consisting of rods, spacers, and links as required to illustrate each assembly.
   2. Bottom bar with sensor edge.
   3. Guides.
   4. Mounting frame.
   5. Brackets.
   6. Hood.

D. Maintenance Data: Submit for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements: Comply with applicable requirements.
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS) 2012.
   2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Installer Qualifications: Entity having minimum 5 years documented experience, employing installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required.

C. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-grille manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cookson Company.
   2. Cornell Iron Works, Inc.
   3. McKeon Rolling Steel Door Company, Inc.
   4. Overhead Door Corporation.

B. Basis of Design: Visionaire ESG20 as manufactured by Cornell Cookson.

C. Open Curtain Grille: Overhead coiling grille with curtain having a network of horizontal rods that interconnect with vertical links.

D. Operation Cycles: Grille components and operators capable of operating for not less than 100,000. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

E. Grille Curtain Material: Aluminum.
   1. Rod Spacing: Approximately 6 inches apart.
   2. Link Spacing: Approximately 3 inches (76 mm) apart in a straight pattern.
   3. Spacers: Metal tubes matching curtain material.

F. Bottom Bar: Continuous tubular shape, fabricated from aluminum extrusion and finished to match grille.

G. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal to metal contact and to minimize operational noise.

H. Hood: Match curtain material and finish.
   1. Shape: Round.
   2. Mounting: Face of wall.

I. Locking Devices: Equip grille with locking device assembly.
   1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside with thumb turn and outside with key.
   2. Ensure key is compatible with the building’s master keying system specified in Section 08 71 00 Door Hardware.

J. Manual Grille Operator: Chain hoist operator
   1. Provide operator with through wall shaft operation.

K. Curtain Accessories: Equip grille with push/pull handles.

L. Grille Finish:
   1. Aluminum Finish: Anodized clear.

2.2 FABRICATION

A. Open Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.
   1. Aluminum Grille Curtain: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Bottom Bar: Continuous shape unless otherwise indicated, finished to match grille.

C. Grille Curtain Jamb Guides: Shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.
   1. Removable Posts and Jamb Guides: Standard.

D. Hood and Accessories: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Aluminum: 0.040 inch (1.02 mm) thick aluminum sheet, complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
   2. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural steel shapes, hot dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.
   3. Push/Pull Handles: Equip push-up-operated or emergency-operated grille with lifting handles on each side of grille, finished to match grille.

E. Locking Device Assembly: Fabricate with cylinder lock, spring loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
   1. Lock Cylinders: Cylinders specified in Section 08 71 00.
   2. Keys: Five for each cylinder.
   3. Install a key switch on both sides of overhead coiling grilles.

F. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

G. Counterbalance Mechanism: Counterbalance grilles by using standard mechanism with an adjustable tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease sealed bearings or self lubricating graphite bearings for rotating members.
   1. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot formed, structural quality, seamless carbon steel pipe, of sufficient diameter and wall thickness to support rolled up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
   2. Counterbalance Spring: One or more oil-tempered, heat treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast steel barrel plugs.
   3. Torsion Rod for Counterbalance Shaft: Fabricate of cold rolled steel, sized to hold fixed spring ends and carry torsional load.
   4. Brackets: Mounting brackets of either cast iron or cold rolled steel plate.

2.3 ELECTRIC GRILLE OPERATORS

A. Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation cycles requirement specified, with electric motor and factory prewired motor controls, starter, gear reduction unit, solenoid operated brake, clutch, control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
   1. Comply with NFPA 70.
   2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
   3. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.
   4. Grille Operator Location(s): Operator location indicated for each grille.
      a. Front of Hood Mounted: Operator is mounted to the right or left grille head plate, with the operator on coil side of the grille hood assembly and connected to the grille drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
   5. Motors: Reversible type motor for motor exposure indicated.

a. Electrical Characteristics:
   1) Phase: Polyphase.
   2) Volts: 115 V.
   3) Hertz: 60.
b. Motor Size: Sized large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
c. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
d. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

6. Limit Switches: Equip motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.
7. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.
   a. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using take up reel or self coiling cable.
      1) Self Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensor edge.
8. Control Station: Provide remote operating console on flush wall plate in Police Office B124 to show current status and remote operation of all overhead coiling grilles included in the construction documents. Remote console shall display the open or closed state of each overhead coiling grille and include a three-button control station with momentary contact controls labeled "Open" and "Stop" and sustained - or constant-pressure control labeled "Close." Remote operating console will allow for independent and universal operations of all overhead coiling grilles included in the construction documents. Overhead coiling grille contractor to install all wiring between remote console and overhead coiling grilles to provide functionality. Provide all sensors and overhead coiling grille motor relays and safety switches to allow overhead coiling grilles to function in local or remote mode. Size all status and control wiring based on distances from remote console to overhead coiling grille location.
   a. Interior Mounted Units: Full guarded, surface mounted, heavy duty type, with general purpose NEMA ICS 6, Type 1 enclosure.
9. Emergency Manual Operation: Equip electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf (111 N).
10. Emergency Operation Disconnect Device: Equip operator with hand operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
11. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.4 FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA Metal Finishes Manual for Architectural and Metal Products (AMP 500-06) for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Finish:
   1. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm] [AA-M12C22A31, Class II, 0.010 mm] or thicker.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for substrate construction and other conditions affecting performance of the Work. Examine locations of electrical connections.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.

B. Install overhead coiling grilles, hoods, controls, and operators at the mounting locations indicated for each grille.

C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power Operated Grilles: Install automatic grille openers according to UL 325.

3.3 STARTUP SERVICE

A. Perform installation and startup checks according to manufacturer's written instructions.

B. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly, so that grilles operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling grille Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for grille operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Perform maintenance, including emergency callback service, during normal working hours.

3.6 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 08 33 26

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SECTION 08 34 73 - SOUND CONTROL DOOR ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Sound controls doors and frames.
   2. Accessories as required for a complete installation.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware.
   2. Section 08 80 00 - Glazing.
   3. Section 09 90 00 - Painting and Coating.

1.3 REFERENCE STANDARDS:

A. ASTM International (ASTM):
   1. A36 Standard Specification for Carbon Structural Steel.
   2. A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
   3. A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   4. A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   5. B117 Standard Method of Salt Spray (Fog) Testing.
   6. D1735 Standard Practice for Testing Water Resistance of Coating Using Water Fog Apparatus.
   7. E90 Standard Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.
   8. E336 Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.
   9. E413 Standard Classification for Rating Sound Insulation.
   10. E512 Standard Practice for Combined, Simulated Space Environment Testing of Thermal Control Materials with Electromagnetic and Particulate Radiation.

B. American Welders Society (AWS).

C. Hollow Metal Manufacturers Association (HMMA): 840 Installation and Storage of Hollow Metal Doors and Frames.

D. National Fire Protection Agency (NFPA): NFPA 80 Standard for Fire Doors and Fire Windows.

E. Underwriters Laboratories, Inc. (UL): UL Directory.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements and manufacturer’s installation instructions.
   2. Manufacturer’s installation instructions.

B. Shop Drawings: Indicate elevations, sections, substrates, fasteners, finishes, hardware, and installation details.

C. Samples: Samples or color charts showing full range of colors available for Architect’s selection.

D. Certifications:

1. Manufacturer's certification that door construction utilized has been tested at an independent laboratory in accordance with ASTM E90, and that the STC determined in accordance with ASTM E413 is not less than that specified in Part 2 of this Section.
2. Manufacturer's certification that door construction has been tested in accordance with ASTM E512 (UL 10B) for labeled fire doors and frames, and meets requirements of NFPA 80 where required.

1.5 PERFORMANCE REQUIREMENTS

A. Acoustic Performance - Other sizes available with manufacturers' minimum ratings:

Door Type	STC
3070 Solid Door	50
3070 w/100 square inch window	50
3070 w/ 1296 square inch window	51
3670 w/100 square inch window	52
4070 w/100 square inch window	54

B. Fire Rating - UL labeled, fire rated, where indicated:

Door Type – One Hour Rated	STC
3070 Solid Door	49
3070 w/ 100 square inch window	48

1.6 QUALITY ASSURANCE

A. Pre-Installation Conference: Refer to Section 01 31 00: Project Management and Coordination.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store all materials on planks or dunnage in a dry location in a vertical position, spaced by blocking to permit air circulation between units. Cover all materials or store in a controlled area to protect from damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed below who produce equivalent products to those specified are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing equivalent products to those specified and comply with Division 01 requirements regarding substitutions to be considered:
   1. Acoustic Systems, Austin, TX; (800) 749-1460.
   2. IAC, North Aurora, IL; (630) 270-1790.
   3. Krieger Specialty Products, Pico Rivera CA; (562) 695-0645.
   4. Overly Door Company, Greensburg, PA; (800) 979-7300.
   5. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 BASIS OF DESIGN

A. Products as manufactured by Wenger Corporation.

2.3 FABRICATION AND COMPONENTS

A. Design Features:
   1. Vision Lite Configuration:
      a. 100 square inches: Three inches (3") wide by 33 inches high narrow window.
      b. 1,296 square inches: 24 inches wide by 54 inches high.
      c. Hinges: Continuous cam-lift hinges.
   2. Seals: Continuous dual magnetic seals.
   3. Design Features:
      a. Innovative isolating crimp design provides a structural connection with minimum sound transmission between panels.

b. Absorptive material integrated into the door frame between magnetic seals.
c. High quality magnetic seals and hinges provide long life with minimum adjustments (typically once every five [5] years or 100,000 cycles).
d. Split-frame design for easier installation in many types of wall construction from four-inch (4") to 12-1/2-inch thick walls.
e. Stainless steel sill plate included.
f. Integrated frame support for sill plate.
g. Fiberglass backed Teflon® sweep seal to minimize friction in opening and closing the door.
h. Door leaf shall be constructed of 12-gauge and 14-gauge steel skins.
i. Door frame shall be constructed of 14-gauge steel.
j. Vision lites shall be constructed of one (1) lite of 1/4-inch thick and 3/8-inch thick laminated safety glass.
k. Mortise pocket is standard for easy lever set integration.

4. Sizes: Three-feet-zero inches by seven feet-zero inches (3'-0" x 7'-0"), three-feet-six inches by seven-feet-zero inches (3'-6" x 7'-0"), and four-feet-zero inches by seven-feet-zero inches (4'-0" x 7'-0") as shown or scheduled on Drawings.

2.4 FINISH

A. Finish: All tool marks and surface imperfections shall be removed, and exposed faces of all welded joints shall be dressed smooth. Assemblies shall be treated and coated on all accessible surfaces with a rust-inhibitive primer that meets ASTM B117 salt spray for 150 hours, and ASTM D1735 water fog test for organic coatings for 200 hours, and that is fully cured prior to shipment.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate with Section 08 71 00: Door Hardware.

3.2 INSTALLATION

A. Install Work of this Section in accordance with manufacturer's instructions and approved shop drawings.

B. Secure the services of a qualified representative of the manufacturer to visit the jobsite and instruct the Contractor's personnel in proper installation and adjustment of the doors and assist, if required, in field tests.

END OF SECTION 08 34 73

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SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Exterior and interior storefront framing.
   2. Exterior and interior manual swing entrance doors.
   3. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 12 00: Structural Steel Framing.
   2. Section 05 40 00: Cold-Formed Metal Framing.
   3. Section 05 50 00: Metal Fabrications.
   4. Section 07 62 00: Sheet Metal Flashing and Trim.
   5. Section 07 92 00: Joint Sealants.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product indicated including construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum framed systems.

B. Shop Drawings:
   1. Submit aluminum storefront framing and entrances shop drawings including plans, elevations, sections, full size details, and attachments to other work:
      a. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
      b. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

D. Engineer’s calculations of performance requirements.

E. Maintenance Data: For aluminum framed systems to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

A. Aluminum framed systems shall withstand the effects of specified performance requirements without exceeding performance criteria or fail due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Noise or vibration created by wind and by thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.

g. Failure of operating units.

B. Structural Loads:
1. Wind loads: As indicated on Drawings.

C. Deflection of Framing Members:
1. Deflection normal to wall plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch ((19 mm)), whichever is less.
2. Deflection parallel to glazing plane: Limited to L/360 of clear span or 1/8 inch ((3.2 mm)), whichever is smaller.

D. Structural Test Performance - Provide aluminum framed systems tested according to ASTM E330 as follows:
1. When tested at positive and negative wind load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test durations: As required by design wind velocity, but not fewer than ten (10) seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).)

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

G. Windborne Debris Impact Resistance:
1. Pass missile impact and cyclic pressure tests when tested according to ASTM E1886 and testing information in ASTM E1996 for Wind Zone 4:
a. Large missile test: For glazed openings located within 30 feet (9.1 m) of grade.

H. Thermal Movements:
1. Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss:
a. Temperature change (range): 120 degrees F (67 degrees C), ambient; 180 degrees F (, 100 degrees C), material surfaces.
b. Interior ambient-air temperature: 75 degrees F (24 degrees C)).

I. Condensation Resistance: Provide aluminum framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x degrees F (3.23 W/sq. m x K) when tested according to AAMA 1503.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Accessibility requirements:
a. 2019 California Building Code: Section 11B-404.3 accessible route.
b. 2019 California Building Code: Section 11B-309.4 operable parts interior usage.

c. S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
d. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.

B. Installer Qualifications: Installer having minimum ten (10) years' documented experience who is an authorized representative of the manufacturer and is trained and approved for installation of units required.

C. Engineering Responsibility: Prepare data for aluminum framed systems, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated.

D. Product Options:
1. Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in service performance:
a. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Source Limitations: Obtain aluminum framed entrances from single source from single manufacturer.

F. Pre-Installation Conference: Conduct conference at site.

1.6 WARRANTY

A. Written warranty signed by manufacturer, Contractor, and installer in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Water leakage through fixed glazing and framing areas.
d. Failure of operating components.
2. Warranty period: Two (2) years from date of Substantial Completion.

B. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering:
1. Warranty period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufactureres:
1. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must be approved by Architect.
a. Kawneer.

B. Basis of Design:
1. Kawneer Trifab 451/451T (Product Evaluation CWSF-34), And/or the Trifab 601/601T, impact resistant system, maximum design pressure +/- 45 psf. Refer to Drawings for frame size and locations.

C. Aluminum:
1. Alloy and temper recommended by manufacturer for type of use and finish indicated:
a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).

c. Extruded Structural Pipe and Tubes: ASTM B 429.
d. Structural Profiles: ASTM B 308/B 308M.

D. Framing Members:
1. Extruded aluminum framing members of thickness required and reinforced necessary to support imposed loads:
a. Construction: Nonthermal/thermal.
b. Glazing system: Retained mechanically with gaskets on four sides.
c. Glazing plane: Center.

E. Accessories:
1. Brackets and reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
2. Fasteners and accessories:
a. Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials:
1) Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2) Reinforce members as required to receive fastener threads.
3. Concrete and masonry inserts: Hot dip galvanized cast iron, malleable iron, or steel inserts, complying with ASTM A123/A123M or ASTM A153/A153M.
4. Concealed flashing: Corrosion resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
5. Framing system gaskets and sealants: Recommended by manufacturer for joint type.

F. Glazing:
1. Refer to Section 08 80 00: Glazing for impact resistant laminated insulating glass with low-e coating on Number 2 surface:
a. Glazing gaskets: Compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
b. Spacers and setting blocks: Elastomeric type.

G. Entrance Doors:
1. Glazed entrance doors for manual swing operation:
a. Door construction: 1-3/4-inch ((44.5 mm)) overall thickness, with minimum 0.125-inch ((3.2 mm)) thick, extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
b. Door design:
1) Wide stile; 5-1/2-inch ((88.9 mm)) nominal width:
(a) Accessible doors: Smooth surfaced for width of door in area within ten inches ((255 mm)) above floor or ground plane.
c. Glazing stops and gaskets: Square, snap on, extruded aluminum stops and preformed gaskets.

H. Entrance Door Hardware:
1. Refer to Section 08 71 00 - Door Hardware for aluminum entrance hardware sets:
a. Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section:
1) Opening-force requirements: CBC Section 11B-404.2.9:
(a) Exterior/interior hinged doors, sliding doors, or folding doors: Five (5) pounds square foot maximum.
(b) Required fire doors: The minimum opening force allowable by DSA not to exceed 15 pounds square foot (these forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position).

(c) Accessible interior doors: Maximum five (5) pounds foot to fully open door.

2) Weather stripping: Standard replaceable components to match existing.

3) Weather sweeps: Standard exterior door bottom sweep with exposed fasteners on mounting strip to match existing.

I. Accessories:

1. Joint sealants: For installation at perimeter of aluminum framed systems, refer to Section 07 92 00: Joint Sealants.
2. Bituminous paint: Cold applied, asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.2 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members:

1. Fabricate components that, when assembled, have specified characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fitted joints with ends coped or mitered.
   c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   d. Physical and thermal isolation of glazing from framing members.
   e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   f. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
   g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   h. Provide sill receptors with end dams at all sill conditions.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Storefront Framing: Fabricate components for assembly using screw spline system.

E. Entrance Door Frames:

1. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware:
   a. At exterior doors, provide weather stripping at fixed stops.
   b. At interior doors, provide weather stripping at stops to prevent metal to metal contact.

F. Entrance Doors:

1. Reinforce doors as required for installing entrance door hardware:
   a. At pairs of exterior doors, provide compression type weather stripping retained in adjustable strip and mortised into door edge.
   b. At exterior doors, provide weather sweeps applied to door bottoms.

G. Aluminum Sun Shade:

1. Aluminum: Extruded aluminum shall be 6063-T5
2. Description: aluminum sunshade consisting of outriggers, louvers, and fascia that is anchored directly to the vertical curtain wall mullions.
3. Outrigger Style: 30” Square
4. Blade Options: Airfoil.
5. Fascia: Square.
6. Color/Finish: As selected by Architect.
7. Product/Manufacturer: Versoleil; Sun Shade by Kawneer or comparable product approved by Architect

H. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.3 ALUMINUM FINISHES

A. Finish: Dark Bronze.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum framed systems by field measurements before fabrication and indicate measurements on shop drawings.

3.2 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.3 INSTALLATION

A. Comply with aluminum framed storefront manufacturer recommended installation instructions. Coordinate installation with curtain wall work:
   1. Do not install damaged components.
   2. Fit joints to produce hairline joints free of burrs and distortion.
   3. Rigidly secure nonmovement joints.
   4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   5. Seal joints watertight unless otherwise indicated.
   6. Min anchorage #8 with two-inch (2”) minimum embedment; minimum two inches (2”) from edges. Refer to shop drawings.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing specified in Section 08 80 00: Glazing.

G. Entrance Doors and Hardware:
   1. Install doors to produce smooth operation and tight fit at contact points:
      a. Exterior doors: Install to produce weathertight enclosure and tight fit at weather stripping.
      b. Field installed entrance door hardware: Install surface mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Section 07 92 00: Joint Sealants to produce weathertight installation.

3.4 ERECTION TOLERANCES

A. Install aluminum framed systems to comply with the following maximum erection tolerances:
   1. Location and plane: Limit variation from true location and plane to 1/8 inch in 12 feet ((3 mm in 3.7 m)); 1/4 inch ((6 mm)) over total length.

2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch ((1.5 mm)).
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch ((0.8 mm)).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch ((3 mm)).

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer:
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a three (3) second closer sweep period for doors to move from a 70-degree open position to three inches ((75 mm)) from the latch, measured to the leading door edge.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance tools and instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
   2. Initial maintenance service: Beginning at Substantial Completion, provide six (6) months full maintenance by skilled employees of entrance door hardware installer. Include quarterly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 43 13

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SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Aluminum-framed curtain wall, with vision glazing and glass and metal infill panels.

B. Related Sections:
   1. Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Proceduresfor submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Shop Drawings: Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.

E. Samples: Submit two samples 12 by 12 inches (305 by 305 mm) in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.

F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

G. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

H. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

I. Designer's Qualification Statement.

J. Installer's Qualification Statement.

K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements: Comply with applicable requirements.
      a. Texas Accessibility Standards (TAS) 2012.

B. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

C. Full-Size Mock-up Testing: Have a specimen representative of project conditions tested by an independent testing agency for compliance with specified thermal, structural, air infiltration, water penetration, and sound attenuation criteria.

D. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties; size, shape, dimensions, material, self-life, storage conditions, and color.

E. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.7 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide mock-up including each component being used on the project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

C. Locate on-site where directed by Architect; mock-up may remain as part of the Work.

D. Locate off-site where directed, and remove when directed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.9 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures for additional warranty requirements.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. Arcadia, Inc: www.arcadiainc.com/#sle.
2. Boyd Aluminum: www.boydaluminum.com/#sle.
3. Coral Architectural Products, a division of Coral Industries, Inc: www.coralap.com/#sle.
4. HMI: www.hmiglass.com/#sle.
5. Kawneer North America: www.kawneer.com/#sle.
6. Manko Window Systems, Inc: www.mankowindows.com/#sle.
7. Oldcastle Building Envelope: www.oldcastlebe.com/#sle.
8. Solar Innovations, Inc: www.solarinnovations.com/#sle.
9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
10. Unicel Architectural Corp: www.unicelarchitectural.com/#sle.
11. Wausau Window and Wall Systems: www.wausauwindow.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 BASIS OF DESIGN

2.3 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Class I natural anodized.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   2. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the applicable code.
   2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
      c. Movement of curtain wall relative to perimeter framing.
      d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 psf (480 Pa).

D. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.27 psf (300 Pa) pressure difference across assembly.

2.4 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Cross-Section: As indicated on drawings.

B. Glazing:

1. Types: Refer to Section 08 80 00 - Glazing.
2. Locations: Refer to Drawings.

2.5 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

C. Glazing Accessories: See Section 08 80 00.

2.6 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Color: As indicated on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.2 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.3 FIELD QUALITY CONTROL

A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 40 00 - Quality Requirements for general testing and inspection requirements.

C. Water-Spray Test: Provide water spray quality test of installed curtain wall components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.4 ADJUSTING

A. Adjust operating sash for smooth operation.

3.5 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.6 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 44 13

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SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash, operating sash, and infill panels.

B. Factory glazing.

C. Operating hardware.

1.2 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.

1.3 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

C. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2021.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

K. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

L. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

D. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.9 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Windows Manufacturers:
1. Arcadia, Inc: www.arcadiainc.com/#sle.
2. Boyd Aluminum: www.boydaluminum.com/#sle.
3. Manko Window Systems, Inc: www.mankowindows.com/#sle.
4. Peerless Products, Inc: www.peerlessproducts.com/#sle.
5. Solar Innovations, Inc: www.solarinnovations.com/#sle.
6. TRACO: www.traco.com/#sle.
7. Wausau Window and Wall Systems: www.wausauwindow.com/#sle.
8. Winco Window Company, Inc; Series 1450HR: www.wincowindow.com/#sle.

2.2 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.

B. Horizontal Sliding; with Matching Fixed Units:
1. Basis of Design: Boyd Aluminum; Series 950 Horizontal Slider, 4 inch deep frame, Thermally Broken: www.boydaluminum.com/#sle.

2.3 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
1. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
2. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
3. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Horizontal Sliding Type:
1. Construction: Thermally broken.
2. Glazing: Single; clear; transparent.
3. Exterior Finish: Class I natural anodized.
4. Interior Finish: Class I natural anodized.

2.4 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5005 alloy, H12 or H14 temper.

C. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.5 HARDWARE

2.6 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 25 00.

3.2 PRIME WINDOW INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install operating hardware not pre-installed by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Provide services of aluminum window manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 40 00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Provide field testing of installed aluminum windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf (91 Pa).
2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf (75 Pa).

D. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.4 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Remove protective material from factory finished aluminum surfaces.

C. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

E. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION 08 51 13

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. Division 28 Section “Access Control Hardware Devices”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.

E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.
4. Five years for motorized electric latch retraction exit devices.
5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. Hager Companies (HA) - CB Series.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.

B. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Manufacturers:

a. Dorma Products (DO).
b. Rixson Door Controls (RF).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

    a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

    a. Sargent Manufacturing (SA).
    b. No Substitution.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. **The hardware distributor provides cylinders for Access control devices, locks and exits.**
6. Keyway: Match Facility Standard.

D. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - Signature Series at exterior.
    b. No Substitution.
    c. 10- Signature supplied on the exterior side of opening only. Not at Mullions or 16- Cylinder dogging

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a **visual key control number as directed by Owner.**
3. New System: Key locks to a new key system as directed by the Owner.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder Group: Seven (7).
2. Master Keys (per Master Key Level/Group): Ten (10).
3. Signature Key Blanks: 150ea
4. Standard Key Blanks: 100ea

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU). 1205A

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

a. Sargent Manufacturing (SA) – 8200 Series.
b. No Substitution.

2.7 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:

   a. Sargent Manufacturing (SA) - 4870 Series.
   b. No Substitution.

B. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 certified narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8" diameter bolts.

1. Manufacturers:

   a. Adams Rite Manufacturing (AD) - MS1850S Series

2.8 INTEGRATED WIRED OUTPUT LOCKING DEVICES – MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Mortise Locks: Wiegand or Open Supervised Device Protocol (OSDP) output ANSI A156.13, Grade 1, mortise lockset with integrated card reader with or without keypad option, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
2. Integrated reader supports the following credentials:
   a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
   b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
   c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
   d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
   e. NFC-enabled mobile phones
   f. PIN code only or PIN + credential with keypad option.
3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 500mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
5. Support end-of-line resistors contained within the lock case.
6. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
8. Manufacturers:
   a. Sargent Manufacturing (SA) – SN200/SN210 8200 Series.
   b. No Substitution.

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.

b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

12. **No self-tapping screws allowed. Drill and tap at all machine screw locations.**

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.
b. No Substitution.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.

2. Provide stabilizers and mounting brackets as required.

3. Provide electrical quick connection wiring options as specified in the hardware sets.

4. Manufacturers:

a. Sargent Manufacturing (SA) - 980S Series.

2.11 INTEGRATED WIRED OUTPUT EXIT DEVICES - MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated card reader with or without keypad option, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Integrated reader supports the following credentials:
   a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
   b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
   c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
   d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
   e. NFC-enabled mobile phones
   f. PIN code only or PIN + credential with keypad option
3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
5. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
6. Manufacturers:
   a. Sargent Manufacturing (SA) – SN200/SN210 80 Series.
   b. No Substitution.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. **Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.**

8. **No self-tapping screws allowed. Drill and tap at all machine screw location.**

9. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

   a. Sargent Manufacturing (SA) - 351 Series.
   b. No Substitution.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide DPDT, surface mounted switches.

1. Manufacturers:

   a. Sentrol (SE) – 2507AD-L.

B. Power Supplies – By Security

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Testing procedures for access control doors are essential to ensure that the system is functioning correctly and providing the necessary level of security.

1. Test the door lock: Verify that the door lock is functioning correctly. Test the lock by using a key or code to unlock the door and ensure that it locks properly when closed.
2. Test the door hardware: Check the door hardware, including the hinges, locks, and other components, to ensure that they are functioning correctly. Verify that the door opens and closes smoothly, and that the hardware is secure.
3. Test the access control equipment using Wiegand tester.
    a. Test card reader by enrolling card into Wiegand Tester. Verify that the lock is working correctly by ensuring that the door unlocks and locks properly when presenting card to reader.
    b. Test Door Position Switch (DPS) by opening door to ensure that the sensors detect open and close signal on Wiegand Tester.
    c. Test Request to Open (REX) using Wiegand Tester to ensure getting open and short signal.
4. Document the results: Keep a record of the testing results and any issues that were identified. This will help you to identify any recurring issues and ensure that the access control system is functioning correctly. Overall, testing procedures for access control doors are critical to ensuring that the system is functioning correctly and providing the necessary level of security. By following these procedures, you can identify any issues and address them before they become a problem.

C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer's Abbreviations:

1. OT - Other
2. MK - McKinney
3. RF - Rixson
4. SU - Securitron
5. RO - Rockwood
6. SA - SARGENT
7. PE - Pemko
8. SE - Sentrol 12345
9. LU - Lund Equipment Co

Hardware Sets based on plans dated 07/10/2025 – 50% CD
Confirm STC openings, revise hardware as required.

Set: 1.0
Doors: A100.1, A100.2, A100.5, B100.1, B100.2, B100.3, C100.1, C100.2, C100.3, C100.4, D100, D100B.1, D100B.2, E100.3, E100.5
Description: *Ext - Alum - Pair - Rim SN200 MELR - KRM - Closer/stop

2	Intermediate Pivot	M190	626	RF
2	Pivot Set	195	626	RF
1	Electric Power Transfer	EL-CEPT	630	SU
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	Ext SN Rim Exit-GMK VK Keys SA	10 TB 43 56-SN200-8804 BIS-OE 862		US32D
1	Rim Exit DT	16 TB 43 8810 862 GMK VK keys	US32D	SA
1	Cylinder GMK VK Keys	980C1	US26D	SA
2	Kit	581-2	EN	SA
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	Rain Guard	346C		PE
2	Sweep w/ Drip	3452AV		PE
1	Lip Threshold	2005AT		PE
1	Perimeter Seal	By door mfgr		OT
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times.

Set: 2.0
Doors: E105, E106, E107

Description: *Ext HM- Rated Mechanical Pair - SN Exit - CLFB - Closer/Stop

6	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Constant Latching Flush Bolt	2805 / 2905	US26D	RO
1	Ext SN Rim HM - GMK VK Keys SA	10 12 TB 43 56-SN200-8804 BIS-0E FSW 644		US32D
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
2	Astragal	303AS		PE
1	Perimeter Seal	2891APK		PE
1	Rain Guard	346C		PE
2	Sweep w/ Drip	3452AV		PE
1	Lip Threshold	2005AT		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
2	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 3.0
Doors: C129.3, D105.3, D111.2, D112E, D113.2
Description: *Ext HM- Single - SN Exit - Closer/Stop

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	SN Rim Exit HM SA	10 TB 43 56-SN200-8804 BIS-0E FSW		US32D
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	Perimeter Seal	2891APK		PE
1	Rain Guard	346C		PE
1	Sweep w/ Drip	3452AV		PE
1	Lip Threshold	2005AT		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 4.0
Doors: D116A.2
Description: *Ext HM- Single - SN Lock - Closer/Stop

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Access Control Mort Lock - Ext SA	10 SN200-82271 BIS-OE LNJ VK Keys		US26D
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA

1	Perimeter Seal	2891APK	PE
1	Rain Guard	346C	PE
1	Sweep w/ Drip	3452AV	PE
1	Lip Threshold	2005AT	PE
1	ElectroLynx Harness	QC-C1500P	MK
2	ElectroLynx Harness	QC-CxxxP	MK
1	Position Switch (Surface Mounted)	2507AD-L	SE
1	Power Supply	By Security	OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 5.0
Doors: A100.3, A100.4
Description: Int - Alum - Vest Pair - Rim/NLL - KRM - Closer/stop

2	Intermediate Pivot	M190	626	RF
2	Pivot Set	195	626	RF
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	Rim Exit Device, NL Int	TB 16 43 8804 862 GMK VK Keys	US32D	SA
1	Rim Exit Device, DT	TB 16 43 8810 862 GMK VK Keys	US32D	SA
1	Cylinder GMK VK Keys	980C1	US26D	SA
2	Kit	581-2	EN	SA
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
2	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	By door mfgr		OT

Set: 6.0
Doors: A140.1, A140.2
Description: *Int - Alum - Pair - Rim SN200 MELR - KRM - Closer/stop

2	Intermediate Pivot	M190	626	RF
2	Pivot Set	195	626	RF
1	Electric Power Transfer	EL-CEPT	630	SU
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	SN Rim Exit - GMK VK Keys	TB 43 56-SN200-8804 BIS-0E 862	US32D	SA
1	Rim Exit DT	16 TB 43 8810 862 GMK VK keys	US32D	SA
1	Cylinder GMK VK Keys	980C1	US26D	SA
2	Kit	581-2	EN	SA
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
2	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	By door mfgr		OT
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
2	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times. Remote release located at reception desk is by security provider. Low voltage wiring.

Set: 7.0
Doors: A101.1
Description: *Int - Alum - Sgl - Rim SN200 MELR - Closer/stop

1	Intermediate Pivot	M190	626	RF	
1	Pivot Set	195	626	RF	
1	Electric Power Transfer	EL-CEPT	630	SU	⚡
1	SN Rim Exit - GMK VK Keys	TB 43 56-SN200-8804 BIS-0E 862	US32D	SA	⚡
1	Kit	581-2	EN	SA	
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA	
1	Door Stop	409 / 462 as req	US32D	RO	
1	Perimeter Seal	By door mfgr		OT	
1	ElectroLynx Harness	QC-C1500P		MK	⚡
2	ElectroLynx Harness	QC-CxxxP		MK	⚡
1	Position Switch (Surface Mounted)	2507AD-L		SE	
1	Power Supply	By Security		OT	

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times. Remote release located at reception desk is by security provider. Low voltage wiring.

Set: 8.0
Doors: E100.1, E100.2
Description: Int - Pair - Rim/CL Lever - KRM - Closer/HO

6	Hinge (heavy weight)	T4A3786	US26D	MK
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	Rim Exit Device, DT Lever	TB 16 43 8810 ETJ GMK VK Keys	US32D	SA
1	Rim Exit Device, Classroom	TB 16 43 8813 ETJ GMK VK Keys	US32D	SA
1	Cylinder GMK VK Keys	980C1	US26D	SA
2	Surface Closer	351 CPSH	EN	SA
2	Door Stop	409 / 462 as req	US32D	RO
2	Silencer	608		RO

Set: 9.0
Doors: A122, B116, C102, D104
Description: Int - Sgl NL Exit

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device, Storeroom	16 TB 43 8804 ETJ GMK VK Keys	US32D	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 10.0
Doors: A130
Description: Int - Rated Pair - SN200 Lock MFB - Closer / Stop - CLFB - Mech

6	Hinge, Full Mortise	TA2714	US26D	MK	
1	Electric Power Transfer	EL-CEPT	630	SU	⚡
1	Constant Latching Flush Bolt	2805 / 2905	US26D	RO	

1	Access Control Mort Lock - Int SA	SN200-82271 BIS-0E LNJ GMK VK Keys		US26D
1	Coordinator	26**	US28	RO
2	Mounting Bracket	2601**	US28	RO
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
2	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Astragal	303AS		PE
1	Perimeter Seal	S773BL		PE
2	Sweep	315CN		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-CxxxP		MK
2	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Closer on active leaf. Door is normally closed and secure. Presentation of valid credential allows entry by trim. Upon loss of power, door will remain secure. Free egress at all times.

Set: 11.0
Doors: A134
Description: *Int - Sgl - IN220 Lock- Closer/stop - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Access Control Mort Lock - Int SA	SN200-82271 BIS-0E LNJ GMK VK Keys		US26D
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-CxxxP		MK
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid credential allows entry by trim. Upon loss of power doors will remain secure. Free egress at all times.

Set: 12.0
Doors: A101.2, A103, A117, A127.1, A127.2, A136, B108, C116, D102.1, D102.2, D107, E101
Description: *Int - Sgl - IN220 Lock- Closer - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Access Control Mort Lock - Int SA	SN200-82271 BIS-0E LNJ GMK VK Keys		US26D
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-CxxxP		MK
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid credential allows entry by trim. Upon loss of power doors will remain secure. Free egress at all times.

Set: 13.0
Doors: C127.1, C127.2
Description: *Int - Sgl - SN200 Lock - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Access Control Mort Lock - Ext SA	10 SN200-82271 BIS-OE LNJ VK Keys		US26D
1	Door Closer	TB 351 UO	EN	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-CxxxP		MK
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid card read allows entry by trim. Remote release button by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times. Remote release located at reception desk is by security provider. Low voltage wiring.

Set: 14.0
Doors: D110A
Description: Int - Pair - Storeroom MFB - Closer

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
2	Kick Plate	K1050 10" BEV CSK	US32D	RO
2	Door Stop	409 / 462 as req	US32D	RO
1	Astragal	303AS		PE
1	Perimeter Seal	S773BL		PE
2	Sweep	315CN		PE

Notes: Closer on active leaf.

Set: 15.0
Doors: B112, C112
Description: Int - Pair - Storeroom MFB - Closer / Stop - OH Stop - Mech

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Surf Overhead Stop	10-x36	689	RF
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
2	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Astragal	303AS		PE
1	Perimeter Seal	S773BL		PE
2	Sweep	315CN		PE

Notes: Closer on active leaf.

Set: 16.0
Doors: A126, C106, C110, D103, D112A, D116A.1
Description: Int - Sgl - Storeroom - Closer - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 17.0
Doors: D106, D116, E108
Description: Int - Sgl - Storeroom - Closer - Gasket - Wide

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 18.0
Doors: B104
Description: Int - Sgl -Storeroom - Closer/stop - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Closer w/ Stop Arm	TB 351 PS	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 19.0
Doors: A104D, A111A, A113, A131A.1, A131A.2, A132A, A140A, C125.2, C129A, D108A, D112G, E100C
Description: Int - Sgl - Storeroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Set: 20.0
Doors: D105B, D109B, D111A
Description: Int - Sgl - Storeroom - STC

3	Hinges	By the STC Door Manufacturer		OT
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Gasketing, threshold, door bottom	By the STC Door Manufacturer		OT

Notes: Door hardware is specified for design intent. Confirm hardware compatibility and design meets the door manufacturer's approved assembly testing for the STC level indicated.

Set: 21.0
Doors: B126
Description: Int - Sgl -Storeroom - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Set: 22.0
Doors: B118
Description: Int - Sgl - Storeroom - Closer - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 23.0
Doors: A112.1, A112.2, C125.3, C129B
Description: Int - Sgl - Classroom - Closer - gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	8237 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 24.0
Doors: A104.2, A114.2, D108
Description: Int - Sgl - Classroom - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	8237 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Set: 25.0
Doors: D112.1, D112.2
Description: Int - Sgl - Sec Classroom - Closer - Holder - Serving

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Security Intruder Lock	8238 LNJ GMK VK Keys	US26D	SA
1	Closer w/ Stop/Hold	TB 351 PSH	EN	SA

1	Kick Plate	K1050 10" BEV CSK	US32D	RO
3	Silencer	608		RO

Set: 26.0
Doors: D111C, D111D, D113A, D113B, D113C
Description: Int - Sgl - Sec Classroom - STC

3	Hinges	By the STC Door Manufacturer		OT
1	Classroom Security Intruder Lock	8238 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Gasketing, threshold, door bottom	By the STC Door Manufacturer		OT

Notes: At aluminum frames, seals/silencers are by frame manufacturer. Door hardware is specified for design intent. Confirm hardware compatibility and design meets the door manufacturer's approved assembly testing for the STC level indicated.

Set: 27.0
Doors: D105.2, D109, D113.1
Description: Int - Sgl - Sec Classroom - Closer - STC

3	Hinges	By the STC Door Manufacturer		OT
1	Classroom Security Intruder Lock	8238 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Gasketing, threshold, door bottom	By the STC Door Manufacturer		OT

Notes: At aluminum frames, seals/silencers are by frame manufacturer. Door hardware is specified for design intent. Confirm hardware compatibility and design meets the door manufacturer's approved assembly testing for the STC level indicated.

Set: 28.0
Doors: A121, A131, A132, A133, B102, B105, B107, B109, B111, B113, B115, B117, B119, B121, B123, B125, B127, C105, C107, C109, C111, C113, C115, C117, C119, C121, C123, C124, C125.1, C129.1
Description: *Int - Sgl - Typical Sec Classroom - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Security Intruder Lock	8238 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Notes: At aluminum frames, seals/silencers are by frame manufacturer.

Set: 29.0
Doors: B101.1, B101.2, B103.1, B103.2, B129.1, B129.2, C101.1, C101.2, C103.1, C103.2, D108B
Description: Int - Sgl - Sec Classroom Exit

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device Sec CR Int	TB 16 43 49 8816 ETJ GMK VK Keys	US32D	SA
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
3	Silencer	608		RO

Notes: At aluminum frames, seals/silencers are by frame manufacturer.

Set: 30.0
Doors: D105.1, D111.1
Description: Int - Sgl - Sec Classroom Exit - STC

3	Hinges	By the STC Door Manufacturer		OT
1	Rim Exit Device Sec CR Int	TB 16 43 49 8816 ETJ GMK VK Keys	US32D	SA
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Gasketing, threshold, door bottom	By the STC Door Manufacturer		OT

Notes: At aluminum frames, seals/silencers are by frame manufacturer. Door hardware is specified for design intent. Confirm hardware compatibility and design meets the door manufacturer's approved assembly testing for the STC level indicated.

Set: 31.0
Doors: A104.1, A105, A106, A107, A109, A109B, A115, A116, A118, A119, A120, D112D
Description: Int - Sgl - Office

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office/Entry Lock	8205 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Notes: At aluminum frame, gasketing / silencers are by frame manufacturer.

Set: 32.0
Doors: A124, A128, A129, E100A, E100B
Description: Int - Sgl - Office - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office/Entry Lock	8205 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Set: 33.0
Doors: D105A, D109A, D111B
Description: Int - Sgl - Office - STC

3	Hinges	By the STC Door Manufacturer		OT
1	Office/Entry Lock	8205 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Gasketing, threshold, door bottom	By the STC Door Manufacturer		OT

Notes: At aluminum frames, seals/silencers are by frame manufacturer. Door hardware is specified for design intent. Confirm hardware compatibility and design meets the door manufacturer's approved assembly testing for the STC level indicated.

Set: 34.0
Doors: A111, A114.1, A140B, B106, C108

Description: Int - Sgl - Workroom - (Office Lock) - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office/Entry Lock	8205 LNJ GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Set: 35.0
Doors: A104B, A104C
Description: Int - Sgl - Passage

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Set	8215 LNJ	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Set: 36.0
Doors: A102, A104A, A108, A110, A131B.1, A131B.2, D112C
Description: Int - Sgl - Privacy - 8225

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Dormitory/Exit Lock	V20 EMB 8225 VN1J VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 37.0
Doors: B110, B120, C104, C118, D101, D114, E102
Description: Int - Sgl - Privacy - Staff - 8251

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom Deadbolt Lock	V20 EMB 8251 VN1J GMK VK Keys	US26D	SA
1	Door Closer	TB 351 UO	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 38.0
Doors: A123, A125, A135, A138, B122, B124, C120, C122, D112B, E103, E104
Description: Int - Sgl - PP - DL - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Public Toilet Deadlock	4878 GMK VK Keys	US26D	SA
1	Push Plate	70E	US32D	RO
1	Pull Plate	111x70C	US32D	RO
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

Set: 39.0

Doors: A100B, A100C, A127, C100D, D100.1, D112.3
Description: OH Door x 2KS

2	Cylinder Ring	1KB-1		SA
2	Cylinder	as required GMK VK Keys	US32D	SA
2	Keyswitch	MK x MKS		SU
1	Balance hardware	by the door manufacturer		OT

Notes: Confirm cylinder type required with door manufacturer.

Set: 40.0
Doors: D100.10
Description: Partition

1	Cylinder Ring	1KB-1		SA
1	Cylinder	as required GMK VK Keys	US32D	SA
1	Balance hardware	by the door manufacturer		OT

Notes: Confirm cylinder type required with door manufacturer.

Set: 41.0
Doors: Misc
Description: MISC

50	Master Key	10-S6272MK	SA
100	Key Blank	6275	SA
150	Key Blank	10-6275	SA
1	Key Cabinet	1205-A 400 Double Tag Key Box	LU
1	Badge Holders	Mifflin USA Clear 2.25x3.5 250 pack	OT

END OF SECTION 08 71 00

SECTION 08 71 13 - POWER DOOR OPERATORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Controllers, actuators, and safety devices.
   2. Maintenance.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware: Balance of door hardware.

1.3 DEFINITIONS

A. Activation Device: Device that sends an electrical signal to door operator to open door when actuated.

B. Knowing Act: Consciously initiating the opening of a power-operated door using acceptable methods, including wall-mounted switches such as push plates and controlled access devices such as keypads, card readers, and key switches.

1.4 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.10 - Power Operated Pedestrian Doors; 2017.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate power door operators with balance of door hardware and electrical work required for each affected door opening.
   1. Templates: Check other sections' shop drawings to confirm that adequate provisions are in place for locating and installing power door operators.
   2. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies, remote activation devices, and electric door latching hardware.

B. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following parties.
   1. Architect.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Shop Drawings:
   1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
   2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

C. Product Data: Provide data on system components, sizes, features, and finishes.

D. Samples: Two samples of exposed to view hardware and attachment hardware.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

F. Maintenance contract.

G. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

H. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

I. Specimen warranty.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 60 00 - Product Requirements for additional provisions.
   2. Wrenches and other tools required for maintenance of equipment.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience, and a member of AAADM.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience and approved by manufacturer.

1.8 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for components of power door operators. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Operators for Swinging Doors:
      a. ASSA ABLOY Entrance Solutions: www.besam-usa.com/#sle.
      b. Detex Corporation: www.detex.com/#sle.
      c. DORMA USA, Inc: www.dorma.com/#sle.
      d. LCN, an Allegion brand: www.allegion.com/us/#sle.
      e. Horton Automatics: www.hortondoors.com/#sle.
      f. NABCO Entrances Inc: www.nabcoentrances.com/#sle.
      g. Portalp USA: www.portalpusa.com/#sle.
      h. Record-USA: www.recorddoors.com/#sle.
      i. Stanley Access Technologies: www.stanleyaccess.com/#sle.
   2. Operators for Sliding Doors:
      a. Stanley Access Technologies: www.stanleyaccess.com/#sle.
   3. Operators for Folding Doors:
      a. NABCO Entrances inc: www.nabcoentrances.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 POWER DOOR OPERATORS - GENERAL

A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.

B. Comply with ADA Standards for egress requirements.

C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.

2.3 CONTROLLERS, ACTUATORS, AND SAFETY DEVICES

A. Controllers: Manufacturer's standard for products specified.
   1. Provide microprocessor operated controller for each door.

B. Actuators: Manufacturer's standard for products specified and as specified below.
   1. Comply with BHMA A156.10 for actuator and safety types and zones.

C. Safety Devices: Manufacturer's standard units recommended for project applications and conditions.
   1. Comply with BHMA A156.10 for actuator and safety types and zones.
   2. Photo-Electric Actuator/Safety: Horizontal single ray device, with aluminum housing for light source and relay units.
   3. Swinging Door Safety Device: Door-mounted proximity detector device arranged to prevent operation of door when persons or obstructions are in the swing zone.

~~**ELECTRICAL CHARACTERISTICS AND COMPONENTS**~~

~~Electrical Characteristics:~~

~~Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.~~

~~Disconnect Switch: Factory mount disconnect switch in control panel.~~

2.4 FINISHES

A. Aluminum Finishes: Manufacturer's standard.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify installation conditions including, but not limited to the following: opening sizes, floor conditions, plumb and level mounting surfaces.

B. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.

C. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.2 INSTALLATION

A. Coordinate installation of components with related and adjacent work.

B. Install equipment in accordance with manufacturer's instructions.

C. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

D. Provide for dimensional distortion of components during operation.

E. Install pneumatic lines and door power units in a manner to prevent condensation or freezing.

3.3 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.4 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate toOwner's Designated Representative equipment operation, operating components, adjustment features, and lubrication requirements.

3.6 MAINTENANCE

A. Refer to Section 01 77 00 - Closeout Procedures for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner.

END OF SECTION 08 71 13

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.1RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Tempered Glass
   2. Insulated Glass
   3. Laminated Safety Glazing
   4. Glazing Sealants.
   5. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C1036.

B. Interspace: Space between lites of an insulating glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glass panels including comprehensive engineering analysis by a qualified professional engineer lawfully licensed in the State of Texas, using performance requirements and design criteria indicated.

B. Installed Glazing: Design glazing systems to withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.
   1. Design Wind Pressures: As indicated on Structural Drawings.
   2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
      a. Wind Design Data: As indicated on Structural Drawings.
      b. Basic Wind Speed: As indicated on Structural Drawings.
      c. Importance Factor: As indicated on Structural Drawings.
   3. Exposure Category: As indicated on Structural Drawings.
   4. Design Snow Loads: As indicated on Structural Drawings.
   5. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
   6. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
   7. Maximum Lateral Deflection: For glass supported on all four edges, limit center of glass deflection at design wind pressure to not more than 1/50 times the short side length or 1 inch (25 mm), whichever is less.

D. Windborne Debris Impact Resistance: Exterior glazing shall comply with -protection testing requirements in ASTM E1996 for when tested according to ASTM E1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.
   1. Large Missile Test: For glazing located within 30 feet (9.1 m) of grade
   2. Small Missile Test: For glazing located more than 30 feet (9.1 m) above grade

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic glass lites, properties are based on units with lites 6 mm thick.
   2. For laminated glass lites, properties are based on products of construction indicated.
   3. For insulating glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center of glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
   5. Solar Heat Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

1.5 SUBMITTALS

A. Product Data: Technical data for each type of product including recommended installation and cleaning procedures.

B. Glass Samples: For each type of glass required. Prepare samples from same material to be used for Work.

C. Glazing Schedule: List glass types and thickness for each size opening and location. Use same designations indicated on Drawings.

D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Product Certificates: Submit glass product certificates required by Code.
   1. Glass Manufacturer Certificate: The glass manufacturer shall submit a letter certifying it has reviewed the glazing details proposed for the project, including the use of gaskets and sealants, and that each product furnished is recommended for the application shown and compliance with the Code.

F. Thermal Stress and Wind Load Analyses: Submit the following from the glass manufacturer:
   1. Thermal stress analysis for each exterior glass unit type, each building elevation. The analysis shall clearly indicate the expected service temperature ranges and the effects of partial and full shading on the glass.
      a. Attach to the thermal stress analysis a statement from the glass manufacturer that based upon this analysis that the resulting thermal stresses will not reduce the specified statistical probability of breakage.
   2. Wind load analysis for each glass unit type, each building elevation. The analysis shall indicate the statistical probability of breakage at the design wind pressure does not exceed the specified statistical probability of breakage.

G. Product Test Reports: Submit test reports for insulating glass and glazing sealants, for tests performed by a qualified testing agency.
   1. Glazing Sealants: Provide test reports based on testing current sealant formulations within previous 36 month period.
   2. Glazing Sealants: Preconstruction adhesion and compatibility test report.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements of the IBC for glazing.
   2. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

a. As a minimum provide Category II materials complying with testing requirements in 16 CFR 1201 (Consumer Product Safety Commission Safety Standard for Architectural Glazing Materials, published in the Code of Federal Regulations) and ANSI Z97.1.
b. Permanently mark safety glass with certification label of Safety Glazing Certification Council.

3. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
4. Glazing Publications: Comply with published recommendations of glass product organizations
   a. GANA: Glazing Manual.
   b. IGMA: SIGMA TM-3000 Vertical Glazing Guidelines.
   c. GANA: Laminated Glazing Reference Manual.
   d. AAMA: AAMA GDSG-1 Glass Design for Sloped Glazing.
   e. AAMA: TIR A7 Sloped Glazing Guidelines.
   f. IGMA for Sloped Glazing: IGMA TB-3001 Guidelines for Sloped Glazing.
   g. IGMA for Insulating Glass: SIGMA TM-3000 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
5. Fire Rated Door Assemblies: Assemblies complying with NFPA 80 listed and labeled by UL for fire ratings indicated, based on testing according to NFPA 252.
6. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
   a. Minimum Glass Thickness for Exterior Lites: 6 mm.
   b. Thickness of Tinted Glass: Provide same thickness for each tint color indicated.
7. Strength: Where annealed float glass is indicated, provide annealed float glass, heat strengthened float glass, or fully tempered float glass necessary to comply with performance requirements.
   a. Where heat strengthened float glass is indicated, provide heat strengthened float glass or fully tempered float glass necessary to comply with performance requirements.
   b. Where fully tempered float glass is indicated, provide fully tempered float glass.

B. Manufacturer Qualifications for Insulating Glass Units with Sputter Coated, Low E Coatings: Insulating glass manufacturer who is approved and certified by coated glass manufacturer.

C. Installer Qualifications, Glazer: Experience entity having minimum 5 years documented experience and who employs glass installers certified under the National Glass Association's Certified Glass Installer Program.

D. Installer Qualifications, Decorative Film: Experience entity having minimum 5 years documented experience in the installation of glass films.

E. Source Limitations for Glass and Glass Accessories: Obtain each type of glass and glass accessories from a single source.

F. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

G. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

H. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

I. Install glazing in mockups specified in to match glazing systems required for Project, including glazing methods.
   1. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

J. Pre-Construction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
   2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
   3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
   4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

K. Pre-Installation Conference: Conduct conference at site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer.

D. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.

E. Comply with insulating glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F (4.4 degrees C).

B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.10 WARRANTY

A. Written warranty, executed by glass manufacturer agreeing to repair or replace glass units that fail in materials and workmanship or deteriorate within warranty period. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to decorative glass manufacturer's published instructions.
   1. Warranty Period: Five (5) years from date of Substantial Completion.

B. Laminated Glass: Written warranty signed by manufacturer in which manufacturer agrees to replace laminated glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

C. Insulating Glass: Written warranty signed by manufacturer in which manufacturer agrees to replace insulating glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Glass:
      a. AGC Glass Company North America, Inc.
      b. Guardian Industries Corp.; SunGuard.
      c. Oldcastle BuildingEnvelope.
      d. Pilkington North America.
      e. Viracon.
      f. Vitro.

B. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

C. Fully-Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.2 INSULATING GLAZING UNITS

A. Insulating Glazing Units: Factory assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.

B. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
   1. Spacer: Aluminum with black, color anodic finish. Thermally broken aluminum
   2. Desiccant: Molecular sieve or silica gel, or a blend of both.
   3. Performance Properties:
      a. Basis of Design Product: As scheduled.
      b. Overall Unit Thickness: 1 inch (25 mm).
      c. Minimum Thickness of Each Glass Lite: 6 mm.
      d. Outdoor Lite: Fully tempered float glass.
      e. Interspace Content: Argon.
      f. Indoor Lite: Fully tempered float glass.
      g. Winter Nighttime U-Factor: As scheduled.
      h. Summer Daytime U-Factor: As scheduled.
      i. Safety glazing required.

2.3 LAMINATED GLAZING

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer, as scheduled, to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Thickness: As required.

B. Windborne Debris Impact Resistant Laminated Glass: Comply with requirements for laminated glass except laminate glass with ionomeric polymer interlayer to comply with interlayer manufacturer's written instructions:

2.4 GLAZING ACCESSORIES

A. Compatibility: Provide glazing sealants compatible with one another and with other materials in contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of service and application, demonstrated by sealant manufacturer based on testing and field experience.

B. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

C. Colors of Exposed Glazing Sealants: As selected by Architect.

D. Glazing Sealant: Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. May National Associates, Inc.; a subsidiary of Sika Corporation.
      d. Pecora Corporation.
      e. Sika Corporation.

E. Glazing Sealant: Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Corporation; Construction Systems.
      b. Dow Corning Corporation.
      c. GE Construction Sealants; Momentive Performance Materials Inc.
      d. May National Associates, Inc.; a subsidiary of Sika Corporation.
      e. Pecora Corporation.
      f. Polymeric Systems, Inc.
      g. Sika Corporation.

F. Glazing Sealant: Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bostik, Inc.
      b. Dow Corning Corporation.
      c. GE Construction Sealants; Momentive Performance Materials Inc.
      d. May National Associates, Inc.; a subsidiary of Sika Corporation.
      e. Polymeric Systems, Inc.
      f. Schnee-Morehead, Inc., an ITW company.
      g. Sika Corporation.

G. Glazing Sealant: Acid curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BASF Corporation; Construction Systems.
   b. Bostik, Inc.
   c. Dow Corning Corporation.
   d. GE Construction Sealants; Momentive Performance Materials Inc.
   e. May National Associates, Inc.; a subsidiary of Sika Corporation.
   f. Pecora Corporation.
   g. Polymeric Systems, Inc.
   h. Schnee-Morehead, Inc., an ITW company.
   i. Sika Corporation.

H. Glazing Sealants for Fire-Resistance-Rated Glazing Products: Neutral curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
   2. Colors of Exposed Glazing Sealants: As selected by Architect.

I. Back Bedding Mastic Glazing Tapes: Preformed, butyl based, 100 percent solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

J. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

K. Miscellaneous Glazing Accessories: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with proven record of compatibility with surfaces contacted in installation.
   1. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
   2. Setting Blocks: Silicone, minimum 4 inches long and wide enough to fully support all lites of glazing unit.
   3. Spacers: Silicone blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   4. Edge Blocks: Silicone material of hardness needed to limit glass lateral movement (side walking).
   5. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
   6. Perimeter Insulation for Fire Resistant Glazing: Product approved by testing agency listed and labeled fire resistant glazing product with which it is used for application and fire protection rating indicated.

2.5 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
   2. Edge and Surface Conditions: Comply with the recommendations of AAMA Structural Properties of Glass for clean cut edges, except comply with manufacturer's recommendations.
   3. Exposed Glass Edges and Surface Condition: Finish edges flat with an arrissed edge profile (small bevel of uniform width not exceeding 1.5 mm at an angle of approximately 45 degrees to the surface of the glass) with polished (surface is reflective in appearance similar to the major surface of the glass) surface.

B. Cutting: Wheel cut or sawed edges and seamed at manufacturer's option. For site cut glass, provide glass 2 inches (50.8 mm) larger than required in both dimensions to facilitate cutting of clean cut edges without the necessity of seaming or nipping. Do not cut, seam, nip or abrade heat treated glass.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Clean glazing channels and framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
   1. Comply with manufacturer instructions for wiping of surfaces immediately before application of primers.
   2. Wipe metal surfaces with IPA (isopropyl alcohol) unless otherwise required by compatibility and adhesion testing results.

B. Inspect each piece of glass immediately before installation. Do not install pieces improperly sized or with damaged edges, scratches, abrasion, or evidence damage. Remove labels from glass immediately after installation.

C. Examine glazing units to locate exterior and interior surfaces. Label or mark units so exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

D. Seal vent (breather or capillary) tubes in insulating glass units in accordance with insulating glass manufacturer written recommendations.

E. Glass Film Preparation:
   1. Remove particulate matter on the glass surface using a scraping blade.
   2. Place an absorbent towel on window sill or sash to absorb moisture generated by the film application.

3.3 GLAZING

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8 inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
   1. Square cut wedge shaped gaskets at corners and install gaskets as recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

K. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, the exposed edges are flush with or protrude slightly above sightline of stops.
   1. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make tapes fit opening.
   2. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
   3. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
   4. Do not remove release paper from tape until right before each glazing unit is installed.
   5. Apply heel bead of elastomeric sealant.
   6. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
   7. Apply cap bead of elastomeric sealant over exposed edge of tape.

L. Gasket Glazing (Dry): Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

1. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
2. Installation with Drive in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
3. Installation with Pressure Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
4. Install gaskets to protrude past face of glazing stops.

M. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

N. Structurally Glazed Units: Set full height continuous structural gaskets/spacers to vertical mullions. Set glass units with void between edge of units and head/sill channel, but with units fully within head/sill rebate so as to provide a proper bite.
1. Align glass unit edges over vertical mullion continuous structural gasket/spacers and secure with manufacturers recommended temporary cleats.
2. Structurally seal glass unit to vertical mullions with specified one part structural silicone sealant. Tool structural silicone flush in alignment to mullion face and perpendicular to face of interior glass light; remove excess structural silicone from glass and metal substrates.
3. After full cure of structural silicone sealant remove temporary cleats. Immediately seal holes left in the vertical mullions caused by temporary cleats.
4. Insert and shape weatherseal joint backer rods, or gaskets, into vertical void between glass units and at a proper depth to receive silicone weatherseal sealant.
5. Place silicone weatherseal sealant into void and tool flush with adjacent exterior glass light faces; remove excess sealant from glass and metal substrates.

O. Erection Tolerances:
1. Maximum Deviation from Vertical: 1/8 inch in any story and 1/4 inch in any 45 foot run.
2. Maximum Deviation from Horizontal: 1/8 inch in any 30 foot run.
3. Maximum Deviation from True Alignment: 1/32 inch for any two (2) abutting units. Allow no edge projections.
4. Maximum Joint Gap: 1/32 inch.

3.4 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
1. If contaminating substances come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

PART 4 SCHEDULE

4.1 GLAZING SCHEDULE

A. Insulating Glazing Units:
1. G-1 Insulated Glass: 1 inch sealed insulated unit consisting of an exterior lite of 1/4 inch low-e tinted tempered float glass, 1/2 inch gas filled air space, and 1/4 inch clear tempered float glass interior lite.
2. Basis of Design: Vitro.
3. Low-e tint shall be Solarban 70 + Solexia or Architect approved equal.

B. Monolithic Security, Insulated Glazing G2: Sealed insulated unit consisting of an exterior lite of ¼ inch low-e tinted tempered float glass, 1/2 inch glass filled air space, and childgard-2118 Security Glazing or comparable product approved by Architect. Refer to Section 08 88 53.
1. Overall Unit Thickness: 1.136 inch.
2. Low-e tint shall be Solarban 70+ Solexia or Architect Approved Equal.
3. Interior Pane: Childguard-2118 Security Glazing by Global Security Glazing or other CGH Inc. Company.
   a. Forced Entry Resistance: ASTM F1233 Class 1.4
   b. Forced Entry Resistance: 5- aa1 rated for a minimum of 16 minutes
   c. Bullet Resistance: HP White TP-0500.03 Level A.
      1) .38 Special Handgun, 3 shots in an 8” circle, 158 grain lead, 20 feet. Spall with no penetration.
   d. Glass Color: Clear.
4. U-Factor: .84
5. Solar Heat Gain Coefficient: .73
6. Overall Visible Light Transmittance: .82
7. Provide Test Report for ASTM F1233 Class 1.4 by Third Party Independent Laboratory.
8. Provide Test Report for 5-aa1 by Third Party Independent Laboratory.
9. Provide Test Report for HP White-TP-0500.03 Level A for Bullet Resistance.
10. Refer to Manufacturers Installation Instructions.

C. Insulated Spandral Glazing:
1. G3 – Insulated Spandral Glazing: 1 inch sealed insulated unit consisting of an exterior lite of 1/4 inch low-e tempered float glass, 1/2 inch gas filled air space, and 1/4 inch clear tempered float glass interior lite with ceramic frit placed in the exterior side of interior lite.
2. Basis of Design: Vitro.
3. Low-e tint shall be Solarban 70+ Solargray or Architect Approved equal.
4. Ceramic Frit Color: RAL-7005 Mouse Gray.

D. Laminated Safety Glazing:
1. G4: Laminated Safety Glass: 1/4 inch (6 mm) laminated safety glass comprised of two (2) 1/8“ (3 mm) glazing quality clear float glass lites, laminated to each side of a clear 0.03 inch polyvinyl butyral (PVB) interlayer.

E. Monolithic Security, Non-Insulated Glazing (G5): Childgard- 2118 Security Glazing or comparable product approved by Architect. Refer to Section 08 88 53.
   1. Overall Unit Thickness: 3/8 inch..
   2. Interior Pane: Childgard-2118 Security Glazing by Global Security Glazing or other CGH Inc. Company.
      a. Forced Entry Resistance: ASTM F1233 Class 1.4
      b. Forced Entry Resistance: 5-aa1 rated for a minimum of 16 minutes
      c. Bullet Resistance: HP White-TP-0500.03 Level A
         1) .38 Special Handgun, 3 shots in an 8” circle, 158 grain lead, 20 feet. Spall with no penetration.
      d. Glass Color: Clear.
   3. Type G-3: 1/4 inch thick glazing quality, clear, tempered float glass.

END OF SECTION

SECTION 08 83 00 - MIRRORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass Mirrors.
   1. Tempered Safety Glass.
B. Decorative mirrors.
C. Tinted Mirrors.
D. Acid-Etched Mirrors.
E. Acrylic Plastic Mirrors.
F. Polycarbonate Mirrors.

1.2 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood mirror frames.
B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

1.3 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.
H. GANA (GM) - GANA Glazing Manual; 2008.
I. GANA (SM) - GANA Sealant Manual; 2008.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
D. Samples: Submit two samples, in size, illustrating mirrors design, edging, and coloration.
E. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.
F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Mirror Glazing: One of each type and size.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.
   1. Maintain one copy on project site.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.6 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Mirrors:
1. Binswanger Mirror/ACI Distribution; ____: www.binswangerglass.com/#sle.
2. Lenoir Mirror Co; ____: www.lenoirmirror.com/#sle.
3. Trulite Glass and Aluminum Solutions; _____: www.trulite.com/#sle.
4. Walker Glass Company Ltd; Walker Glass Mirrors: www.walkerglass.com/#sle.
5. _____.
6. Substitutions: Refer to Section 01 60 00 - Product Requirements.

B. Decorative Mirrors:
1. GGI - General Glass International; Antique Mirror: www.generalglass.com/#sle.
2. Walker Glass Company Ltd; Walker Textures Acid-Etched Mirrors: www.walkerglass.com/#sle.
3. _____.
4. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: ASTM C1036, Type 1 - Transparent Flat, Class 1 - Clear, Quality - Q1 (high-quality mirrors); silvering, protective coating, and quality requirements in compliance with ASTM C1503.
1. Thickness: 1/4 inch (6 mm).
2. Size: As indicated on drawings.

2.3 GLAZING COMPOUNDS

A. Acrylic Sealant: ASTM C920, Type S, Grade NS, Class 12-1/2, Uses M and A; single component, solvent curing, non-bleeding; cured Shore A hardness of 15 to 25; clear color.

B. Polysulfide Sealant: ASTM C920, Type M, Grade NS, Class 25, Uses M and A ; two component; chemical curing, non-sagging type; cured Shore A hardness of 15 to 25; color as selected.

C. Polyurethane Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses M and A; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35; color as selected.

D. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses M and A; single component; chemical or solvent curing; non-bleeding, non-staining, cured Shore A hardness of 15 to 25; color as selected.

2.4 ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.

C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.

D. Glazing Clips: Manufacturer's standard type.

E. Mirror Attachment Accessories: Stainless steel clips.

F. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
   1. Application Temperature: Minus 35 to 140 degrees F (Minus 37 to 60 degrees C) at contact surfaces.
   2. Volatile Organic Content (VOC): Less than 7 percent by weight.

G. Rolled Formed Frame: One piece, roll-formed angle frame, stainless steel, Type 430, satin finish, with welded frame corners, ground and polished smooth.

H. J-Shape Frame: Aluminum extrusion, dimensions as detailed on drawings.
   1. Material: Comply with ASTM B221 (ASTM B221M), 6005-T6 alloy and temper.
   2. Finish: Anodized, clear.
   3. Four-Sided Frame: Mitered joints.
   4. Manufacturers:
      a. Eagle Mouldings, Inc; Aluminum J Caps and Channels: www.eagle-aluminum.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

I. U-Shape Frame: Aluminum extrusion, dimensions as detailed on drawings.
   1. Material: Comply with ASTM B221 (ASTM B221M), 6005-T6 alloy and temper.
   2. Finish: Anodized, clear.
   3. Four-Sided Frame: Mitered joints.
   4. Manufacturers:
      a. Eagle Mouldings, Inc; Aluminum Channel Extrusions: www.eagle-aluminum.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

J. Channel Frame: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep (12.7 mm by 12.7 mm by 9.5 mm deep) with 90 degree mitered corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Installation in Frames:
   1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
   2. Place setting blocks at one-quarter points with edge block no more than 6 inches (152 mm) from corners.
   3. Rest mirrors on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
   4. Place glazing tape on free perimeter of mirrors in same manner described above.
   5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
   6. Trim protruding tape edge.

E. Installation in Frames:
   1. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
   2. Place setting blocks at one-quarter points with edge block no more than 6 inches (152 mm) from corners.
   3. Rest mirrors on setting blocks and push against tape to ensure full contact at perimeter of mirror.
   4. Install removable stops, insert spacer shims between mirrors, and apply stops at 24 inches (610 mm) on center and at 1/4 inch (6.4 mm) below sight line.
   5. Fill gaps between mirror and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
   6. Trim protruding tape edge.

F. Installation in Frames:
   1. Install mirrors resting on setting blocks. Install applied stop and center mirror by use of spacer shims at 24 inches (610 mm) on center and at 1/4 inch (6 mm) below sight line.
   2. Locate and secure mirror using spring wire clips.
   3. Fill gaps between mirror and stops with glazing compound until flush with sight line, and tool surface to straight flush line.

G. Frameless Mirrors: Set mirrors in proper place with adhesive, applied in accordance with adhesive manufacturer's instructions.

H. Frameless Mirrors: Set mirrors with clips, and anchor rigidly to wall construction.

3.4 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

END OF SECTION 08 83 00

SECTION 08 91 19 - FIXED LOUVERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Fixed, extruded aluminum and formed metal louvers.
   2. Accessories necessary for a complete installation.

1.3 REFERENCE STANDARDS

1.4 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).

D. Drainable Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Wind Driven Rain Resistant Louver: Louver that provides specified wind driven rain performance determined by testing according to AMCA 500-L.

1.5 SUBMITTALS

A. Product Data: Technical data for each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings:
   1. For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing:
      a. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
      b. Show mullion profiles and locations.
      c. Windstorm: Design loads as indicated on drawings.

C. Samples: Submit for units with factory applied color finishes.

1.6 QUALITY ASSURANCE

A. Delegated Design Submittal: For louvers indicated to comply with structural [and seismic] performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

C. Windborne debris impact resistance test reports.

D. Regulatory Requirements:
   1. SMACNA Standard: Comply with recommendations in SMACNA Architectural Sheet Metal Manual for fabrication, construction details, and installation procedures.
   2. Welding - Qualify procedures and personnel according to the following:
      a. AWS D1.2/D1.2M Structural Welding Code - Aluminum.

E. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory applied color finish.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209/B209M, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Galvanized Steel Sheet: ASTM A653/A653M, G90 (Z275) zinc coating, mill phosphatized.

D. Stainless Steel Sheet: ASTM A240/A240M, Type 304, No. 4 finish, with grain running parallel to length of blades and frame members..

E. Fasteners - Use types and sizes to suit unit installation conditions:
1. Use tamper resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot dip galvanized steel or 300 series stainless steel fasteners.
4. For fastening stainless steel, use 300 series stainless-steel fasteners.
5. For color finished louvers, use fasteners with heads that match color of louvers.

F. Post installed Fasteners for Concrete and Masonry: Torque controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.2 FIXED, EXTRUDED ALUMINUM LOUVERS

A. Horizontal Continuous Line, Drainable Blade Louver: Drainable blade louver with blade gutters (drains) in rear two/thirds of blades only and with semirecessed mullions capable of collecting and draining water from blades:
1. Manufacturers are subject to compliance with requirements. Provide products of one of the following:
   a. Airolite Company, LLC (The).
   b. Arrow United Industries.
   c. Construction Specialties, Inc.
   d. Greenheck Fan Corporation.
   e. Ruskin Company; Tomkins PLC.
2. Basis of Design: K6746MD as manufactured by Arolite.
3. Louver Size: Refer to Drawings.
4. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
5. Louver Performance Ratings:
   a. Free Area: Not less than 7.8 sq. ft. (0.72 sq. m) for 48 inch (1220 mm) wide by 48 inch (1220 mm) high louver.
   b. Point of Beginning Water Penetration: Not less than 850 fpm (4.3 m/s).
   c. Air Performance: Not more than 0.10 inch wg (25 Pa) static pressure drop at 800 fpm (4.1 m/s) free area exhaust velocity.

2.3 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies:

1. Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field bolted assembly with close fitting joints in jambs and mullions, reinforced with splice plates:
    a. Continuous Vertical Assemblies: Fabricate units without interrupting blade spacing pattern unless horizontal mullions are indicated.
    b. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less:
1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close fitting blade splices designed to permit expansion and contraction.
2. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
4. Exterior Corners: Prefabricated corner units with mitered blades with concealed close fitting splices and with fully recessed mullions at corners.

G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FINSHES

A. Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.

B. Aluminum Finishes:
1. Finish louvers after assembly.
2. Baked Enamel or Powder Coat Finish:
    a. AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish:
        1) Color and Gloss: Selected by Architect.
3. High Performance Organic Finish:
    a. Two coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions:
        1) Color and Gloss: Selected by Architect.

C. Galvanized Steel Sheet Finishes:
1. Finish louvers after assembly.

2. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A780/A780M.
3. Baked Enamel or Powder Coat Finish:
   a. Immediately after cleaning and pretreating, apply two coat, baked on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils (0.05 mm):
      1) Color and Gloss: Selected by Architect.

D. Stainless Steel Sheet Finishes: Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

3.2 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation after correcting unsatisfactory conditions.

3.3 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.4 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 for sealants applied during louver installation.

3.5 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units:
   1. Touch up minor abrasions in finishes with air dried coating that matches color and gloss of, and is compatible with, factory applied finish coating.

END OF SECTION 08 91 19

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SECTION 09 05 00 - COMMON WORK RESULTS FOR FINISHES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Substrate testing.
   2. Stone thresholds.
   3. Waterproof membranes.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete design, underslab vapor barrier and finished concrete surface required to accept flooring adhesive and finish flooring system.
   2. Section 03 54 00 - Cast Underlayment: Leveling of existing concrete slabs.
   3. Section 05 77 00 - Decorative Extruded Metal: Extruded metal transitions and trim.
   4. Section 06 10 00 - Rough Carpentry: Wood-based panel underlayment required to accept installation of finish flooring systems.
   5. Section 06 16 00 - Sheathing: For proper wood-based panel underlayment required to accept installation of finish flooring systems.
   6. Section 09 65 13 - Resilient Base and Accessories.
   7. Section 09 65 19 - Resilient Tile Flooring.
   8. Section 09 68 00 - Carpeting.

1.3 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

C. ASTM C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method; 2007 - Not Active.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.

F. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

G. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.

H. ASTM F1482 - Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring; 2021.

I. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

J. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

K. ISO/IEC 17025 - General Requirements for the Competence of Testing and Calibration Laboratories; 2017.

1.4 DEFINITIONS

A. Refer to Section 01 42 16 - Definitions for the following terms:
   1. Adhesives.

2. Leadership in Energy and Environmental Design (LEED).
3. Volitile Organic Compound (VOC)

1.5 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's printed descriptions of materials, components and systems; performance criteria; use limitations; preparation instructions and recommendations; storage and handling requirements and recommendations; and installation methods.

B. Certificates:
   1. Submit with manufacturer’s signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
      a. Provide Master Grade Certificate as specified in ANSI A137.1.

C. Test and Evaluation Reports:
   1. Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.

D. Samples:
   1. Submit samples showing full range of color and texture variations expected.
   2. Full size units of each type and composition of tile and for each color and finish required.
   3. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required; minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   4. Waterproof membrane in 6 inch by 6 inch (150 mm by 150 mm) sample.
   5. Thresholds in 6 inch (150 mm) lengths.

E. Closeout Submittals:
   1. Operation and Maintenance Data: Including, but not limited to, methods for maintaining installed products and precautions against cleaning materials with methods detrimental to finishes and performance.
   2. Executed Warranty Documentation: Manufacturers’ material warranties and installers workmanship warranty.
   3. Record Documents: Drawings, Specifications, Product Data.

1.6 PERFORMANCE REQUIREMENTS

A. Refer to the following for specific sub-flooring and finish flooring requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete.
   2. Section 03 54 00 - Cast Underlayment.
   3. Section 09 30 13 - Ceramic Tiling.
   4. Section 09 30 16 - Quarry Tiling.
   5. Section 09 30 23 - Glass Tiling.
   6. Section 09 30 33 - Stone Tiling.
   7. Section 09 65 19 - Resilient Tile Flooring.
   8. Section 09 68 00 - Carpeting.

B. Static Coefficient of Friction (SCOF): For tile installed on walkway surfaces which are not anticipated to be wet, provide products with values determined by testing identical products per ASTM C1028:
   1. Level Surfaces: Minimum 0.6.
   2. Ramp Surfaces: Minimum 0.8.

C. Dynamic Coefficient of Friction (DCOF): Per ANSI A137.1 Section 9.6 DCOF AcuTest:
   1. Wet Level Surfaces: Minimum 0.42 unless noted otherwise.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Surface Burning Characteristics: ASTM E84; identify products with appropriate markings of applicable testing agency.
      a. Flame Spread Index: 25 or less.
      b. Smoke Developed Index: 450 or less.
   2. Accessibility Requirements: Comply with applicable requirements.
      a. ADA Standards.
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS) 2012.

B. Qualifications:
   1. Installer / Applicator: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have a minimum three (3) years successful experience in installations of similar size and scope.
   2. Testing Agency: An independent testing agency with the experience and capability to conduct the testing indicated, meeting requirements of ISO/IEC 17025 or ASTM E329 and ASTM E699.

C. Source Limitations:
   1. Obtain spray-applied adhesive through one source from a single manufacturer.
   2. Obtain tile of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
   3. Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
      a. Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
         1) Stone thresholds.
         2) Waterproofing.
         3) Joint sealants.
         4) Cementitious backer units.
         5) Metal edge strips.

D. Sustainability Standards and Certifications:
   1. Adhesive and Sealant VOC Limits: According to South Coast Air Quality Management District Rule 1168 and GS-36 for aerosols.
   2. VOC Limits: As tested using U.S. EPA Reference Test Method 24 and as defined by
      a. South Coast Air Quality Management District Rules: In areas where exposure to freeze/thaw conditions and direct exposure to moisture will not occur.
         1) SCAQMD Rule 1168, Adhesive and Sealant Applications
      b. California Air Resources Board: For areas where freeze/thaw conditions do exist or direct exposure to moisture can occur.
         1) CARB for containers 16 oz. or less.

E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of each type of floor tile installation.
   2. Build mockup of each type of wall tile installation.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage and Handling per manufacturer’s recommendations, Section 01 60 00 - Product Requirements, and as follows:
   1. Delivery and Acceptance Requirements

a. Deliver materials to Project site in an undamaged condition, in original, unopened and undamaged packages or containers bearing manufacturer's intact label, names, brand names, types and thicknesses of contents, and proper handling, storing, unpacking, protecting, and installation instructions, as warranted.
   1) Comply with requirements in ANSI A137.1 for labeling tile packages.
b. Inspect shipped materials on delivery to ensure compliance with requirements of Contract Documents and to ensure that products are undamaged and properly protected. Reject damaged goods and accept properly ordered, protected and undamaged goods.

2. Storage and Handling Requirements
   a. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided. Store liquid materials in unopened containers and protected from freezing.
   b. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
   c. Store adhesive materials in a dry, temperature-controlled interior area at 65-80 deg F (18-27 deg C). Protect materials from damage from improper handling, exposure to temperature extremes, and the action of other trades.
3. Packaging Waste Management
   a. Request in writing that manufacturers, fabricators, suppliers and shippers provide least amount of packaging that adequately and properly protects, supports and contains the items shipped, and is reusable, returnable or recyclable.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

C. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.10 EXTRA STOCK

1.11 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 - Project Management and Coordination.

1.12 WARRANTY

A. Refer to related sections for specific product warranty requirements.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Conditions and Measurements: Visit jobsite to verify installation conditions and floor measurements.

B. Ambient Conditions per manufacturer’s written recommendations, and as follows:
   1. New concrete slabs shall be flat, clean and dry meeting all moisture tests passing manufacturer’s written requirements.

2. Environmental Limitations: Maintain temperature and relative humidity per manufacturer's recommendations.
    a. Maintain space, substrate temperatures, and RH for time prior to, during and after installation as recommended.
3. Acclimate floor finish materials into spaces they will be installed a minimum 48 hours in advance of installation.
    a. Do not install until all floor finish materials are same temperature as space where they are to be installed.

3.2 EXAMINATION - GENERAL

A. Contractor shall examine preparatory work by others, with Installer/Applicator present, for compliance with requirements affecting Work performance.
    1. Contractor shall notify Architect of any issues which would affect installation of finish. Absence of such notification shall constitute acceptance of responsibility by Contractor.

B. Verify that field measurements, surfaces, substrates, structural support, tolerances, levelness, plumbness, temperature, humidity, moisture content level, cleanliness, and other conditions are as required by the manufacturer, and ready to receive Work.

3.3 EXAMINATION - FLOORING

A. Verify that concrete floors to receive resilient flooring meet ASTM F710 requirements and are flat as recommended by floor finish manufacturer.

B. Verify that wood and panel type underlayment substrates to receive resilient flooring meet ASTM F1482 requirements and are flat as recommended by floor finish manufacturer.

C. Test substrates as required by manufacturer to verify proper conditions.
    1. Portland-Cement Concrete:
        a. Perform moisture testing to verify that concrete substrate is sound and dry. Both of the following tests are required:
            1) Perform relative humidity (RH) test using in situ probes per ASTM F2170 . Proceed with installation only after each substrate measures a maximum 75 percent RH.
            2) Perform anhydrous calcium chloride testing per ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 7 lbs of water/1000 sf (3.18 kg of water/92.9m2) in 24 hours.
        b. Perform alkalinity testing to verify pH level is 11 or below per ASTM F710.
        c. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
    2. Wood Underlayment: Shall be dry, clean, structurally sound, well nailed and/or glued, free of voids and with joints that do not exceed 1/16 inch (1.6mm) per floor finish manufacturer's installation instructions.
    3. Proceed with installation only after unsatisfactory conditions have been corrected.
        a. Commencement of work related to this Section will constitute acceptance of conditions.

3.4 INSTALLATION - GENERAL

A. Lay out tilng so that no tile is cut to less than 1/2 of its full size in either direction.

B. Slope tile within 3 foot diameter of a floor drain, unless otherwise noted.

C. Form internal angles square.

3.5 INSTALLATION - STONE SHRESHOLDS

A. Set marble thresholds in accordance with TCA TR611 and manufacturer's instructions.

3.6 FIELD QUALITY CONTROL

A. Site Tests and Inspections:

1. Inspect floor finish system installation for non-conforming Work including, but not limited to, the following:
   a. Lack of adequate adhesion.
   b. Adhesive overspray.
      1) Clean off water-based adhesive overspray with a damp cloth.
   c. Improper substrate preparation as indicated by:
      1) Air blisters.
      2) Buckling.
      3) Cracks.

3.7 CLEANING

A. Clean finishes as required and in accordance with manufacturer's recommendations.

3.8 CLOSEOUT ACTIVITIES

A. Refer to Section 01 77 00 - Closeout Procedures.

END OF SECTION 09 05 00

SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
      a. Resilient tile and sheet.
      b. Broadloom carpet.
      c. Carpet tile.

B. Related Sections:
   1. Section 09 65 00 - Resilient Flooring.
   2. Section 09 68 00 - Carpeting.

1.3 REFERENCE STANDARDS

1.4 DEFINITIONS

A. Refer to Section 01 42 16 - Definitions for the following terms:
   1. Adhesives.
   2. Leadership in Energy and Environmental Design (LEED).
   3. Volitile Organic Compound (VOC).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.6 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Adhesive Bond and Compatibility Test Report.

C. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.

1.7 PERFORMANCE REQUIREMENTS

A. Refer to the following for specific sub-flooring and finish flooring requirements:
   1. Section 09 65 19 - Resilient Tile Flooring.
   2. Section 09 68 00 - Carpeting.

1.8 QUALITY ASSURANCE

A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
   2. Acceptable Testing Agencies:
      a. Independent Floor Testing & Inspection, Inc. (IFTI): www.ifti.com/#sle.
      b. Other testing agency approved by Owner.

c. Substitutions: Not permitted.

C. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.

B. Deliver materials in manufacturer's packaging; include installation instructions.

C. Keep materials from freezing.

1.10 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 MATERIALS

A. Patching Compund: Refer to Section 03 54 00 - Cast Underlayment

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Spray-Applied Adhesive:
1. Water-based pressure-sensitive aerosol adhesive, VOC- Free, non-flammable, and non-HAP, emitting no dangerous fumes or odors.
2. Manufacturers:
   a. Spray-Lock by Interlock Industries, Inc., (706) 517-8989.

PART 3 EXECUTION

3.1 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.2 PREPARATION

A. Refer to individual floor covering section(s) for additional requirements.

B. Comply with recommendations of testing agency.

C. Comply with requirements and recommendations of floor covering manufacturer.

D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

E. Do not fill expansion joints, isolation joints, or other moving joints.

3.3 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.4 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.5 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

3.6 APPLICATION OF SPRAY-APPLIED ADHESIVE

A. Installation per each floor finish assembly product manufacturer’s written instructions, and as follows:
   1. Spray-Applied Adhesive Method:
      a. Do not place finish-flooring product until adhesive applied to substrate is ready to receive it per adhesive manufacturer’s instructions.
      b. Mark floor equivalent to manufacturer’s recommended area for size of container used. Apply no more or less adhesive than what manufacturer recommends.
      c. Outline perimeter of the room with a 4-5 inch (100-125 mm) wide band of adhesive. Apply the adhesive from 8-12 inches (200-300 mm) above the substrate.
      d. Lay flooring finish material, adjust and reset until layout placement is certain.
      e. Following installation of finish flooring (typically within an hour after installing) roll entire floor area with a 75 to 100 lb (34 to 45 kg) roller to ensure proper bonding with instant shear strength.
   2. Close space to traffic for 2 hours before beginning installation, however, flooring is immediately available after rolling for all range of use.

3.7 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION 09 05 61

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SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Gypsum board.
   2. Partition framing systems.
   3. Exterior gypsum board for ceilings and soffits.
   4. Tile backing panels.
   5. Ceiling suspension systems.
   6. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
   2. Section 05 40 00 - Cold Formed Metal Framing: Structural steel stud framing.
   3. Section 06 10 00 - Rough Carpentry: Building blocking.
   4. Section 07 92 00 - Joint Sealants: Acoustical joint sealant.
   5. Section 08 44 13 - Glazed Aluminum Curtain Walls.

1.3 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.

I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

L. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

M. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.

N. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets; 2017.

O. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022.

P. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

Q. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.

R. ASTM C1766 - Standard Specification for Factory-Laminated Gypsum Panel Products; 2015 Edition, February 1, 2015.

S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

T. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation; 2009 Edition, March 1, 2009

U. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

V. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

W. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.4 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Comply with manufacturer's load tables and the following design pressures and deflections:
   1. Stairs, Elevator Hoistways, and Vertical Shafts: 1/120 at 10 psf.
   2. Ground Floor Lobbies: 1/120 at 15 psf.
   3. Partitions Receiving Stone Cladding, Lath and Plaster, or Plaster Veneer: 1/360 at 15 psf.
   4. Partitions Receiving Monitors, Televisions, Heavy Audio/Visual Equipment: 1/360 at 15 psf.
   5. Typical Partitions: 1/240 at 5 psf.
   6. Other Partitions: 1/240 at 5 psf.
      a. Maximum Deflection:
         1) L/240 at 5 lbf per sq. ft.
         2) L/120 at 5 lbf per sq. ft.
         3) L/120 at 7.5 lbf per sq. ft.
         4) L/120 at 10 lbf per sq. ft.

B. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

C. STC Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1.5 SUBMITTALS

A. Product Data: Submit For each type of drywall including calculations for loadings and stresses of exterior walls and specially fabricated framing based on manufacturer’s load tables.

B. Shop Drawings: Indicate locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of work.

C. Samples:
   1. Trim Accessories: Full size Sample in 12 inch (300 mm) long length for each trim accessory indicated.
   2. Textured Finishes: 12 inch by 12 inch (300 mm by 300 mm) for each textured finish indicated and on same backing indicated for work.

D. Calculations: Submit calculations verifying steel partition stud minimum base metal thickness and depth compliance with Code and ASTM C645 for height, load, and deflection.

E. Evaluation Reports: ICC-ES reports for dimpled steel studs and runners and firestop tracks.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with applicable requirements of building code for interior finishes.
   2. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. Single Source Responsibility:
   1. Framing Members: Obtain steel framing members from single manufacturer.
   2. Panel Products: Obtain each type of gypsum board and other panel products from single manufacturer.
   3. Finishing Materials: To the extent possible, obtain finishing materials from same manufacturer supplying gypsum board products. When not possible, obtain materials from manufacturer acceptable to gypsum board manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 for gypsum board manufacturer's written instructions, whichever are more stringent.
   1. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.

B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

D. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Steel Studs and Tracks:
      a. CEMCO; California Expanded Metal Products Co.
      b. ClarkDietrich.
      c. Custom Stud.

d. MBA Building Supplies.
e. MRI Steel Framing, LLC.
f. Phillips Manufacturing Co.
g. Steel Network, Inc. (The).
h. Telling Industries.

2. Gypsum Board:
   a. Certainteed Corporation.
   b. Georgia Pacific.
   c. National Gypsum Company.
   d. USG Corporation.
3. Tile Backer Board:
4. Glass Mat Gypsum Sheathing Board:
5. Cementitious Board:
6. Trim:

2.2 MATERIALS

A. Framing Members: ASTM C754 for component sizes and conditions under specified maximum deflection and lateral loading conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for metal.
   2. Protective Coating: ASTM A653/A653M, G60 (Z180), hot dip galvanized.

B. Steel Framing Components: ASTM C754 for conditions indicated; hot dip galvanize complying with ASTM A653/A653M Z180.
   1. Steel Studs and Runners: ASTM C645, 0.0179 inch (0.45 mm) minimum base metal thickness; depth indicated on Drawings.
   2. Dimpled Steel Studs and Runners: ASTM C645, equivalent to minimum base metal thickness indicated on Drawings for depth indicated on Drawings.
   3. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
   4. Cold-Rolled Channel Bridging: 0.0538 inch (1.37 mm) bare steel thickness, with minimum 1/2 inch (12.7 mm) wide flanges; depth indicated on Drawings.
   5. Clip Angle: Not less than 1-1/2 inches by 1-1/2 inches (38.1 mm by 38.1 mm), 0.068 inch (1.73 mm) thick, galvanized steel.
   6. Hat Shaped, Rigid Furring Channels: ASTM C645; 0.0179 inch (0.45 mm) minimum base metal thickness; depth indicated on Drawings.
   7. Resilient Furring Channels: 1/2 inch (12.7 mm) deep, steel sheet members designed to reduce sound transmission. Configuration: Asymmetrical or hat shaped.
   8. Cold Rolled Furring Channels 0.0538 inch (1.37 mm) bare steel thickness, with minimum 1/2 inch (12.7 mm) wide flanges.
      a. Depth: As indicated on Drawings.
      b. Furring Brackets: Adjustable, corrugated edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
      c. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625 inch (1.59 mm) diameter wire, or double strand of 0.0475 inch (1.21 mm) diameter wire.
   9. Z-Shaped Furring Channels: With slotted or non-slotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
   10. Auxiliary Framing Materials: Fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
   11. Slip Type Head Joints: Where indicated, provide one of the following:
      a. Single Long Leg Runner System: ASTM C645 top runner with 2 inch (50.8 mm) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging, located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

b. Double Runner System: ASTM C645 top runners, inside runner with 2 inch (50.8 mm) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
c. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide one of the following:
1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
2) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
3) Superior Metal Trim; Superior Flex Track System (SFT).

C. Gypsum Board: ASTM C1396/C1396M, applicable to type of gypsum board indicated and whichever is more stringent.
1. Wall Board:
a. Type: X.
b. Thickness: 5/8 inch (15.9 mm).
c. Long Edges: Tapered and featured (rounded or beveled) for pre-filling.
2. Ceiling Board: Manufactured for sag resistance
a. Type: X typical, C at fire-resistance-rated ceiling assemblies.
b. Thickness: 1/2 inch (13 mm).
c. Long Edges: Tapered.
3. Moisture and Mold Resistant Type: Type X with moisture and mold resistant core and surfaces.
a. Type: X.
b. Thickness: 5/8 inch (15.9 mm).
c. Long Edges: Tapered.
4. Shaft Liner Type:
a. Type: X.
b. Thickness: 1 inch (25.4 mm).
5. Fire-Resistant Core, Foil-Backed: ASTM C1396/C1396M
a. Basis of Design: Gold Bond® Foil Back Gypsum Board manufactured by National Gypsum Company.
b. Thickness: 5/8 inch (15.9 mm).
c. Core: Type X.
d. Edges: Tapered.

D. Impact Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.
1. Core and Thickness: 5/8 inch (15.9 mm), Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meet or exceed Level 1 requirements.
3. Indentation: ASTM C1629/C1629M, meet or exceed Level 1 requirements.
4. Soft Body Impact: ASTM C1629/C1629M, meet or exceed Level 1 requirements.
5. Hard Body Impact: ASTM C1629/C1629M, meet or exceed Level 1 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to STM D3274.

E. Acoustically Enhanced Gypsum Board: ASTM C1766. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
1. Manufacturers: Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of ten (10) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
a. CertainTeed Corp.; Silent FX QC.
b. National Gypsum Company; Sound Break.

c. PABCO; QuietRock.
d. G-P/Temple Inland; Comfort Guard Sound.
2. Core: Regular Type.
3. Long Edges: Tapered.

F. Reinforced Gypsum Sheathing (Tile Backer Board): ASTM C1178/C1178M, standard edges. Cellulose fiber reinforced panels may be used in lieu of cementitious board.
1. Core and Thickness: 5/8 inch (15.9 mm) to match conditions, Type X.
2. Long Edge: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

G. Glass Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with standard edges.
1. Core: Type X.
2. Thickness: 5/8 inch (15.9 mm).
3. Size: 48 inches by 96 inches (1219 mm by 2438 mm).
4. Long Edges: Tapered

H. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325.
1. Thickness: 1/2 inch (12.7 mm) and 5/8 inch (15.9 mm) to match conditions.
2. Long Edges: Standard.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

I. Exterior Trim: ASTM C1047, hot dip galvanized steel sheet, plastic, or rolled zinc.
1. Shapes:
a. Cornerbead.
b. LC Bead: J shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One piece, rolled zinc with V shaped slot and removable strip covering slot opening.

J. Interior Trim: ASTM C1047; galvanized or aluminum coated steel sheet, rolled zinc, plastic, or paper faced galvanized steel sheet.
1. Shapes:
a. Cornerbead.
b. Bullnose bead.
c. LC Bead: J shaped; exposed long flange receives joint compound.
d. L Bead: L shaped; exposed long flange receives joint compound.
e. U Bead: J shaped; exposed short flange does not receive joint compound.

K. Expansion (Control) Joint.
1. Manufacturers: Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
a. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.

L. Continuous Corner Bead: Extruded Aluminum; continuous integral fin for surface contact with gypsum board; 7/8 inch (22 mm) wide, tapered to edge; punched with holes staggered to accept screw fastening. Prime with corrosion resistant primer.
1. Manufacturer: Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
a. Fry Reglet Corporation.
b. Pittcon Industries.

c. Schluter Systems.

2. Basis of Design Product: Pittcon Softforms SO-HSE-90

M. Joint Treatment: ASTM C475/C475M.

1. Joint Tape:
   a. Exterior Gypsum Soffit Board: Paper.
   b. Joint Compound for Exterior Applications, Glass Mat Gypsum Sheathing Board: Recommended by sheathing board manufacturer.
   c. Joint Tape, Interior Gypsum Board: Paper.
2. Joint Compound:
   a. Gypsum Board: Pre-Filling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting type taping compound.
      1) Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting type taping compound.
         (a) Use setting type compound for installing paper faced metal trim accessories.
      2) Fill Coat: For second coat, use setting type, sandable topping compound.
      3) Finish Coat: For third coat, use setting type, sandable topping compound.
      4) Skim Coat: For final coat of Level 5 finish, use setting type, sandable topping compound.
   b. Cementitious Units: Recommended by backer unit manufacturer.
   c. Tile Backing Panels: Recommended by backer unit manufacturer.
   d. Water Resistant Gypsum Backing Board: Use setting type taping compound and setting-type, sandable topping compound.
   e. Joint Compound, Glass Mat Sheathing Board: Recommended by sheathing board manufacturer.

N. Auxiliary Materials: Comply with referenced installation standards and manufacturer's written recommendations.

1. Steel Drill Screws: ASTM C1002, use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. Sound Attenuation Blankets: Refer to Section 09 81 00 - Acoustic Insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow metal frames, cast in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.

B. Gypsum Board Assemblies: Comply with requirements in ASTM C840 applicable to framing installation.

C. Framing Assembly: Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

1. Install studs so flanges within framing system point in same direction. Space studs in single layer application as indicated on drawings.

2. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
    a. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
        1) Install two studs at each jamb, unless otherwise indicated.
        2) Install cripple studs at head adjacent to each jamb stud, with minimum 1/2 inch (12.7 mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
        3) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
    b. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
3. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

D. Sound Insulation: Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

E. Gypsum Panels: Comply with ASTM C840. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
1. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
2. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
3. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
4. Form control and expansion joints with space between edges of adjoining gypsum panels.
5. Cover both faces of support framing with gypsum panels in concealed spaces, except in chases braced internally.
    a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
    b. Fit gypsum panels around ducts, pipes, and conduits.
    c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 inch to 3/8 inch (6.4 mm to 9.5 mm) wide joints to install sealant.
6. Isolate perimeter of gypsum board applied to non-load bearing partitions at structural abutments, except floors. Provide 1/4 inch to 1/2 inch (6.4 mm to 12.7 mm) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
7. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Gypsum Board: Install interior gypsum board where indicated on drawings.
1. Single Layer Application:
    a. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.

b. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and minimize end joints. Stagger abutting end joints not less than one framing member in alternate courses of panels.
c. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

2. Multilayer Application:
a. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
b. On Z shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
c. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

G. Backing Panels:
1. Cementitious Backer Units: ANSI A108.11; install where indicated with 1/4 inch (6.4 mm) gap where panels abut other construction or penetrations. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

H. Exterior Gypsum Board Soffits: Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4 inch (6.4 mm) open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

I. Trim Accessories: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Attach trim according to manufacturer's written instructions.
1. Control Joints: Install control joints according to ASTM C840 (30 feet maximum), at each door and window jamb (unless noted otherwise), and in specific locations indicated on Drawings.
2. Exterior Trim: Install in the following locations:
a. Cornerbead: Use at outside corners.
b. LC Bead: Use at exposed panel edges.
3. Interior Trim: Install in the following locations:
a. Cornerbead: Use at outside corners, unless otherwise indicated.
b. Bullnose Bead: Use at outside corners.
c. LC Bead: Use at exposed panel edges.
d. L Bead: Use where indicated or necessary.
e. U Bead: Use at exposed panel edges.

J. Gypsum Board Finishing: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
1. Pre-fill open joints, rounded or beveled edges, and damaged surface areas.
2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
3. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
a. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
b. Level 2: Panels that are substrate for tile.
c. Level 3: Where indicated on Drawings.

d. Level 4: For surfaces receiving flat paints.
e. Level 5: For surfaces receiving gloss or semi-gloss paint, subjected to severe lighting, or receiving wall covering.

4. Glass Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
5. Glass Mat Faced Panels: Finish according to manufacturer's written instructions.

K. Installation Tolerances:
1. Suspension System: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
2. Installation Tolerances, Suspension System: Install suspension systems level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

L. Fire-Resistance-Rated and Smoke Partitions Markings
1. Each fire-resistance rated partition, smoke partition, or other wall requiring protected openings is to be marked as such as defined below.
a. Location: Mark walls in accessible concealed floor, floor-ceiling, and attic spaces.
b. Spacing: Markings shall be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition.
c. Lettering: Stenciled letters a minimum of 3 inches in height with a minimum 3/8 inch stroke in a color contrasting with the wall material (typically black) paint. Markings shall be one of the following, appropriate to the partition type, as indicated on plans.
1) “SMOKE PARTITION – PROTECT ALL OPENINGS”.
2) “#-HR FIRE BARRIER – PROTECT ALL OPENINGS” where #-HR is as indicated on the Drawings.
3) “#-HR FIRE WALL – PROTECT ALL OPENINGS” where #-HR is as indicated on the Drawings.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16

SECTION 09 24 00 - CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Exterior plasterwork (stucco).
   2. Metal framing and accessories.
   3. Metal lath and furring.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Submit technical data for product and accessory, including construction details and material descriptions.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: Submit samples for each type of factory prepared finish coat and for each color and texture specified, 12 inches by 12 inches (305 mm by 305 mm), and prepared on rigid backing.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable provisions of the IBC and the IECC for building enclosures.
   2. Fire Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Perform testing on mockups according to specified requirements.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
   5. When directed, remove mockups from site.

C. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

B. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with applicable requirements of ASTM C 926.

B. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

C. Cold Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.

D. Warm Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

E. Ventilation: Provide natural or mechanical means of ventilation to properly dry interior spaces after portland cement plaster has cured.

F. Exterior Plasterwork:
1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 degrees F (4.4 degrees C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

G. Protect contiguous Work from soiling and moisture deterioration caused by plastering. Provide temporary covering and take precautions necessary to minimize spattering of plaster on adjacent Work.

H. Factory Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

1.7 WARRANTY

A. Warrant the work specified for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to the following:
1. Cracking excessively without external causes.
2. Delaminating or releasing from substrate.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Listed manufactures whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.

1. Metal Lath and Accessories:
   a. Alabama Metal Industries; (205) 366-2642.
   b. CEMCO; (800) 775-2362.
   c. ClarkDietrich Building Systems; (800) 543-7140.
   d. Marino/WARE; (800) 627-4661.
   e. Phillips Manufacturing; (800) 822-5055.

2. Wire Fabric Lath:
   a. Davis Wire; (800) 350-7851.
   b. C.E. Shephard Co., L.P.; (713) 924-4300.
   c. Keystone Steel and Wire Co.; (309) 697-7607.
   d. K-Lath; (800) 663-0955.

3. Plastic Accessories:
   a. Alabama Metal Industries; (205) 366-2642.
   b. Phillips Manufacturing; (800) 822-5055.
   c. Plastic Components; (800) 327-7977.
   d. Vinyl Corp.; (305) 477-6464.

4. Ready Mixed Finish Coat Plaster:
   a. California Stucco Product; (201) 457-1900.
   b. El Rey Solutions; A Parex Company; (877) 547-8822.
   c. Florida Stucco; (561) 487-1301.
   d. Omega Products International; (800) 600-6634.
   e. Quikrete; (800) 282-5828.
   f. Shamrock Stucco; (800) 785-3131.

5. Acrylic Based Finish Coat:
   a. California Stucco Product; (201) 457-1900.
   b. Dryvit Systems; (800) 556-7752.
   c. El Rey Solutions; A Parex Company; (877) 547-8822.
   d. Finestone, BASF Corp; (800) 669-2273.
   e. Omega Products International; (800) 600-6634.
   f. Senergy, BASF Corp.; (800) 669-2273.
   g. Sto Corp.; (800) 221-2397.

B. Cold Formed Steel Framing: Refer to Section 05 40 00 for steel framing for exterior plaster (stucco).

C. Steel Studs and Runners: Refer to Section 09 21 16 for steel partition framing for interior plaster.

D. Soffit Framing: Refer to Section 05 40 00.

E. Metal Lath:

1. Expanded Metal Lath: ASTM C 847, cold rolled carbon steel sheet with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized zinc coating.
   a. Diamond Mesh Lath: Self furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).

2. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper
   a. Provide paper backed lath at exterior locations.

F. Accessories: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
1. Metal Accessories:
   a. Foundation Weep Screed: Fabricated from hot dip galvanized steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
   b. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized-zinc coating.
   c. Outside Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized zinc coating.
   d. Cornerbeads: Fabricated from zinc or zinc coated (galvanized) steel.
      1) Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
      2) Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.

   e. Casing Beads: Fabricated from zinc or zinc coated (galvanized) steel; square edged style; with expanded flanges.
   f. Control Joints: Fabricated from zinc or zinc coated (galvanized) steel; one piece type, folded pair of unperforated screeds in M shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
   g. Expansion Joints: Fabricated from zinc or zinc coated (galvanized) steel; folded pair of unperforated screeds in M shaped configuration; with expanded flanges.
   h. Two Piece Expansion Joints: Fabricated from zinc or zinc coated (galvanized) steel; formed to produce slip joint and square edged reveal adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.

2. Plastic Accessories: Manufactured from high impact PVC.
   a. Cornerbeads: With perforated flanges.
      1) Smallnose cornerbead; use unless otherwise indicated.
      2) Bullnose cornerbead, radius 3/4 inch (19 mm) minimum; use at locations indicated on Drawings.

   b. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
      1) Square edge style; use unless otherwise indicated.
      2) Bullnose style, radius 3/4 inch (19 mm) minimum; use at locations indicated on Drawings.

   c. Control Joints: One piece type, folded pair of unperforated screeds in M shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
   d. Expansion Joints: Two piece type, formed to produce slip joint and square edged [**1/2 inch (13 mm)**] [**1 inch (25 mm)**] [**1-1/2 inch (38 mm)**] wide reveal; with perforated concealed flanges.

G. Miscellaneous Materials:
1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
2. Fiber for Base Coat: Alkaline resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
3. Bonding Compound: ASTM C 932.
4. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.

5. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475 inch (1.21 mm) diameter unless otherwise indicated.
6. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
    a. Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.

H. Plaster Materials:
1. Portland Cement: ASTM C 150/C 150M.
    a. Color for Finish Coats: Match existing.

2. Colorants for Job Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color selected by Architect.
3. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
4. Sand Aggregate: ASTM C 897.
    a. Color for Job Mixed Finish Coats: White**.**

5. Exposed Aggregates for Finish Coats: Match existing.
6. Ready Mixed Finish Coat Plaster: Mill mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
    a. Color: Selected by Architect.

7. Acrylic Based Finish Coatings: Factory mixed acrylic emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic based finishes.
    a. Color: Selected by Architect.

2.2 PLASTER MIXES

A. Comply with ASTM C 926 for applications indicated.
1. Fiber Content: Add fiber to base coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Base Coat Mixes for Use over Metal Lath: Scratch and brown coats for three coat plasterwork:
1. Portland Cement Mix:
    a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
    b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Job Mixed Finish Coat Mixes:
1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

D. Factory Prepared Finish Coat Mixes: For ready mixed finish coat plasters or acrylic based finish coatings, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Protect adjacent Work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.3 INSTALLATION

A. Metal Lath: Install according to ASTM C 1063.
   1. Partition Framing and Vertical Furring: Flat diamond mesh lath.
   2. Horizontal Framing: Flat diamond mesh lath.

B. Accessories: Install according to ASTM C 1063 and at locations indicated on Drawings.
   1. Reinforcement for External (Outside) Corners:
      a. Install [lath type, external corner reinforcement] [cornerbead] at exterior locations.
      b. Install cornerbead at interior locations.

   2. Control Joints: Locate as approved by Architect for visual effect:
      a. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
         1) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
         2) Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).

      b. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
      c. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
      d. Where control joints occur in surface of construction directly behind plaster.
      e. Where plasterwork areas change dimensions, to delineate rectangular shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.4 PLASTER APPLICATION

A. Comply with ASTM C 926.
   1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
   2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
   3. Provide plaster surfaces ready to receive field applied finishes indicated.

B. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces, measured by a 10 foot (3m) straightedge placed at any location on surface.

C. Walls; Base Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three coat plasterwork with 1 inch (26 mm) total thickness:
   1. Portland cement mixes.

D. Plaster Finish Coats: Apply to provide dash finish.

E. Acrylic Based Finish Coatings (Contractor Option to Plaster Finish Coat): Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

F. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.5 PLASTER REPAIRS

A. Repair or replace Work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

B. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other Work. Repair cracks and indented surfaces. Point up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace Work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.6 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet (3mm in 3 m).

B. Maximum Variation from True Position: 1/8 inch (3mm).

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of Work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

B. Remove unused materials, containers, equipment, and plaster debris.

C. Protect plaster and maintain conditions ensuring finished plaster is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 24 00

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Thin set porcelain tile, mortar and grout, sealants, and accessories shown or required to complete work.

1.3 SUBMITTALS

A. Product Data: Technical data including data sheets, installation recommendation, and recommended joint widths.

B. Shop Drawings: Show locations of each type of tile and tile pattern.
   1. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples: Submit samples showing full range of color and texture variations expected.
   1. Full size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required; minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Waterproof membrane in 6 x 6-inch sample.
   4. Thresholds in 6 inch (150 mm) lengths.

D. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements for slip resistance.

E. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

F. Certifications:
   1. Provide Master Grade Certificate as specified in ANSI A137.1.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for the IBC for interior finishes.
   2. Surface Burning Characteristics: ASTM E 84; identify products with appropriate markings of applicable testing agency.
      a. Flame Spread Index: 25 or less.
      b. Smoke Developed Index: 450 or less.

   3. Accessibility Requirements: Comply with applicable requirements.
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS) 2012.

B. American National Standards Institute (ANSI)
   1. Installation Specifications:
      a. A108, Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
      b. A108.10, Installation of Grout in Tilework.

   2. Material Specifications:
      a. A118.4, Modified Dry Set Cement Mortar.
      b. A118.6, Ceramic Tile Grouts.
      c. A137.1, Ceramic Tile.

C. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

D. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

E. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
   1. Stone thresholds.
   2. Waterproofing.
   3. Joint sealants.
   4. Cementitious backer units.
   5. Metal edge strips.

F. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products. Contractor shall provide certified moisture testing results per ASTM F2170 (*Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes*) in new construction or ASTM F1869 (Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride) in renovations to Architect and Owner prior to floor installation. Acceptable moisture content of concrete sub floor shall be within approved manufacture limits or lower prior to installation.

G. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of each type of floor tile installation.
   2. Build mockup of each type of wall tile installation.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided. Store liquid materials in unopened containers and protected from freezing.

C. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

C. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full size units equal to three (3) percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to three (3) percent of amount installed for each type, composition, and color indicated.

1.8 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 – Project Management and Coordination.

1.9 WARRANTY

A. Warrant the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Damaged tile, including broken or chipped edges.
   2. Loose or missing tile.
   3. Noticeable deterioration or discoloring of tile or grout.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Specifications are based on products of manufacturers specified. Manufacturers listed below who produce equivalent products to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions in order to be considered.
   1. Tile:
      a. American Marazzi Tile, Inc.; (972) 226-0110.
      b. American Olean Tile Co.; (214) 398-1411.

c. American Tile; (713) 939-1077.
d. Crossville Ceramics Co.; (931) 484-2110.
e. Dal-Tile Corp., Dallas, TX; (713) 481-5893.
f. Trinity Surfaces.
g. Artaic Glass.

2. Tile Setting and Grout Materials: Those manufactured by any one (1) of the following. No substitutions.
a. Custom Building Products; (562) 598-8808.
b. Dal-Tile Corp.; (713) 481-5893.
c. Laticrete International, Inc., Bethany, CT; (800) 243-4788.
d. Mapei Americas; (800) 426-2734.

B. Specifications are based on porcelain tile as manufactured by Dal-Tile Corp. Other manufacturers listed shall provide colors and finish equivalent to those specified.

2.2 MATERIALS

A. T1, T2, T3 : 24 inches by 48 inches by 3/8 inch thick sealed porcelain tile with cushioned edge.
1. Basis of Design: Paragon manufactured by Trinity Surfaces.
2. Color: Refer to the Drawings.
3. Finish: Matte.
4. Locations: Each type shall be as shown on drawings.
5. Borders and Patterns: As shown on drawings.

B. T6, T7, T8, T9: 6 inch by 24 inch porcelain tile.
1. Basis of Design: Shades 2.0 as manufactured by Crossville Studios.
2. Color: Refer to the Drawings.
3. Finish: Matte.
4. Locations: Each type shall be as shown on drawings.
5. Borders and Patterns: As shown on drawings.

C. T10, T11, T12, T13, T14, T15, T16: 5 inch by 5 inch porcelain tile.
1. Basis of Design: TWISTER as manufactured by Crossville Studios – WOW Design
2. Color: Refer to the Drawings.
3. Finish: Gloss.
4. Locations: Each type shall be as shown on drawings.
5. Borders and Patterns: As shown on drawings.

D. T17: 12 inch by 24 inch porcelain tile.
1. Basis of Design: Shades 2.0 as manufactured by Crossville Studios.
2. Color: Refer to the Drawings.
3. Finish: Matte.
4. Locations: Each type shall be as shown on drawings.
5. Borders and Patterns: As shown on drawings.

E. T18, T19: 2 inch by 8 inch ceramic tile.
1. Basis of Design: SEKIRA as manufactured by Trinity Surfaces.
2. Color: Refer to the Drawings.
3. Finish: Glossy.
4. Locations: Each type shall be as shown on drawings.
5. Borders and Patterns: As shown on drawings.

F. T20: 1 inch by 1 inch Vitreous Glass.
1. Basis of Design: ARTAIC as manufactured by Artaic Glass.

2. Color: Refer to the Drawings.
3. Finish: Custom Design.
4. Locations: Each type shall be as shown on drawings.
5. Borders and Patterns: As shown on drawings.

G. Type D: Trim and Deco Strips porcelain tile in various sizes and finishes.
1. Color: To be selected by Architect from manufacturer's full color line.
2. Locations: Each type shall be as shown on drawings.
3. Borders and Patterns: As shown on drawings.

H. Mortar Adhesive: LATICRETE® 254 Platinum Thin-Set Mortar as manufactured by Laticrete International, Inc., Bethany, CT; (800) 243-4788, FlexBond Premium Flexible Bonding Mortar as manufactured by Custom Building Products, Seal Beach, CA; (562) 598-8808, or 1300 Universal Bonding Mortar as manufactured Dal-Tile Corp., Dallas, TX; (800)-933-8453, Keraflex Super as manufactured by Mapei Americas, Deerfield Beach, FL; (800)-426-2734.

I. Grout: LATICRETE® Tri-Poly Fortified Grout as manufactured by Laticrete International, Inc., or Architect approved equal by any one (1) of the approved manufacturers listed above. No substitutions. Color shall be as selected by Architect from manufacturer's standard colors.

J. Epoxy Grout (At wet areas and restroom floors): Use one (1) of the following 100 percent solids epoxy grout in accordance with ANSI A118.3. No substitutions. Color shall be as selected by Architect from manufacturer's full line of available colors:
1. ARDEX L.P., WA Epoxy Grout; (724) 203-5000.
2. Polyblend® Tile Grout with 100 percent Solids Epoxy manufactured by Custom Building Products; (562) 598-8808.
3. LATICRETE® SpectraLOCK PRO Stainless Grout manufactured by Laticrete International, Inc.; (800) 243-4788.
4. Kerapoxy IEG, 100% Solids, Industrial-Grade Epoxy Grout manufactured be Mapei Americas; (800)-426-2734.

K. Crack Isolation Membrane:
1. Sheet membrane used to eliminate transmission of substrate cracks from one (1) of the following approved Products/Manufacturers:
a. Dalseal CIS manufactured by Dal-Tile.
b. Crackbuster manufactured by Custom Building Products.
c. Mapelastic SM manufactured by Mapei.
d. Nobleseal CIS manufactured by The Noble Company.
e. Tileguard manufactured by Polyguard Products, Inc.

2. Liquid membrane with fiberglass mesh from one (1) of the following approved Products/Manufacturers in accordance with ANSI A118.12:
a. Blue 92 manufactured by Laticrete International, Inc.
b. Fracturefree manufactured by Custom Building Products.

L. Expansion Joint:
1. Filler: Flexible and compressible, closed-cell type, rounded at surface to contact sealant as instructed by sealant manufacturer to suit intended use.
2. Typical Conditions except as specified below: Silicone compound sealant over filler. ASTM C920, Uses M and A, single component, mildew resistant. Sanded to match grout. Provide at all wall corners, ceilings, control joints and changes in materials, where floor tile abuts perimeter walls, curbs, columns, and pipes; and 24 feet to 36 feet elsewhere.
3. Conditions exposed to chemicals, food processing, etc.: Polysulfide sealant over filler. ASTM C920, Grade P, Class 25, Uses T and M. Polyspec Thiokol, or Architect approved equal. Self-leveling and flexible sealant over filler of type instructed by manufacturer to

suit application. Sealant shall match grout color. Expansion joints shall conform to TCA EJ171.

M. Latex Floor Leveling Material: ARDEX K-15 Self-Leveling Underlayment Concrete manufactured by ARDEX ENGINEERED CEMENTS; (724) 203-5000 or comparable product approved by Architect.

N. Edge Protection and Transition Strips:
1. Basis of Design: Schluter® Systems LP, Plattsburg, NY; (800) 472-4588.
2. Porcelain Tile to Gyp. Bd.: Schluter® - QUADEC transition strips in aluminum finish at all porcelain tile wainscot to gyp board transition locations.
3. Porcelain Tile to Porcelain Tile: Schluter® - QUADEC transition strips in aluminum finish at all porcelain tile wall outside corner locations.
4. Porcelain Tile to Carpet: Schluter® - SCHIENE transition strips in aluminum finish at porcelain tile to carpet transition locations.
5. Porcelain Tile to Sealed Concrete: Schluter® - RENO-U edge protection in satin aluminum finish at porcelain tile to sealed concrete.
6. Stair nosing: Schluter® - TREP-S GS, 10 S, aluminum support with thermoplastic rubber insert.
7. Edge Protection: Schluter® - DECO-DE. Brushed Stainless.
8. Provide all corners and connectors as required for a complete and detailed finished installation.

2.3 EXTRA TILE

A. Deliver four (4) unopened boxes of tile of each color tile and base from the same tile production run to the Owner at Substantial Completion.

PART 3 - EXECUTION

3.1 PREPARATION

A. By General Contractor:
1. Protect surrounding work from damage or disfiguration.
2. Vacuum clean and damp clean existing substrate surfaces.

B. By Tile Contractor:
1. Examine preparatory work by others and notify Architect of any imperfections which would affect a satisfactory completion of this tile work.
2. Examine substrates defects which may affect the work. Do not start work until defects have been corrected. Ensure that surfaces are:
a. Free of cracks, dry, clean, free of oily or waxy films, free of curing compounds.
b. Well cured, firm and level within TCA specified tolerances.
c. Minimum of 40 degrees F and rising.

C. Absence of such notification shall constitute acceptance of responsibility by tile contractor.

3.2 INSTALLATION

A. Crack Isolation Membrane:
1. Install crack isolation membrane under tile over building control joints and substrate cracks up to 1/8 inch. Apply a 30 inch wide strip centered on control joint or crack. Install in accordance with TCA F125 and manufacturer's instructions.
2. Install joint sealant in joint of first tile on both sides of control joint and crack.

3. Install membrane with products or methods approved by membrane manufacturer when joining, sealing, fastening, or adhering sheet membranes.

B. Install porcelain wall tile and porcelain pavers with aligned joints (no staggering), 1/8 inch to 3/16 inch joint width.

C. Install porcelain pavers over crack isolation membrane in locations shown on drawings in accordance with TCA F125 and ANSI A108.5 recommendations and manufacturer's instructions.

D. Do not use damaged porcelain tile, including those with broken or cracked edges.

E. Lay out all work so that, where possible, no tiles less than half size occur.

F. Install expansion joints in accordance with TCA publication EJ171. Install porcelain tile joints aligned with floor joints.

G. Install grout in accordance with ANSI A108.10 and manufacturer's instructions.

H. Install edge protection and transition strips in accordance with manufacturer's instructions.

I. Damp cure grout in accordance with manufacturer's recommendations. Clean all porcelain tile surfaces upon completion. Protect finish porcelain tile work from damage.

3.3 CLEANING AND PROTECTION

A. Clean work at completion of installation, remove excess grout from porcelain tile surfaces. Wipe all tile with a clean damp cloth, and buff lightly, leaving tile surfaces clean and ready to use.

B. Remove grout from adjacent finish surfaces.

C. Protect finished installation until final acceptance.

D. Do not permit traffic over finished floor surface.

3.4 REPAIR

A. Repair or replace damaged porcelain tile, including those with broken or cracked edges at no expense to Owner.

END OF SECTION 09 30 00

SECTION 09 51 00 - ACOUSTICAL CEILING PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Acoustical panels.
   2. Concealed and exposed suspension systems for ceilings.
   3. Ceiling panel for food service area.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each product including installation instructions.

B. Samples:
   1. Acoustic Panel: Set of 6 inch (150 mm) square samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch (300 mm) long samples of each type, finish, and color.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which suspension systems will be attached.
   3. Size and location of initial access modules for acoustical panels.
   4. Items penetrating finished ceiling including but not limited to the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
   5. Perimeter moldings.

D. Maintenance Data: Manufacturer data for finishes for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements of the IBC for interior finishes.
   2. Acoustical Panel Standard: ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance.
      a. Mounting Method for Measuring NRC: Plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
   3. Surface Burning Characteristics: Ceiling panels with surface burning characteristics complying with IBC Chapter 8 and ASTM E 1264 for Class A materials determined by testing identical products in accordance with ASTM E 84:
      a. Flame Spread Index : 25 or less
      b. Smoke Developed Index: 450 or less.
   4. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   5. Fire Resistance Ratings: Comply with ASTM E 119; testing by qualified testing agency. Identify products with appropriate markings of applicable testing agency. Indicate design

designations from UL Fire Resistance Directory or from the listings of another qualified testing agency.

B. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Comply with applicable regulations regarding toxic and hazardous materials.
   1. Coating Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
   2. Panel Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the panels.

D. Preinstallation Conference: Conduct conference at site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to site in original, unopened packages and store in a fully enclosed, conditioned space protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, allow panels to attain room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.7 WARRANTY

A. Standard Ceiling Panels: Warrant ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of one (1) year from the date of Substantial Completion.

B. Sag Resistant Ceiling Panels: warrant products to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of ten (10) years from the date of Substantial Completion.

C. Standard Suspension System: Suspension systems shall be warranted to be free from defects in material or factory workmanship and shall not incur 50 percent red rust as defined by ASTM B117 test procedures for a period of ten (10) years from the date of Substantial Completion.

D. Suspension system / ceiling panels: Provide manufacturers standard 15 year warranty for suspension systems when used in combination with same manufacturers sag resistant ceiling panels. Ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects. Suspension systems shall not incur 50 percent red rust as defined by ASTM b117 test during the period of the warranty, extra materials.

1.8 EXTRA STOCK

A. Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full size panels equal to 1 percent of quality installed or 2 full unopened containers, whichever is greater.

2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold Down Clips: Equal to 2 percent of quantity installed.
4. Impact Clips: Equal to 2 percent of quantity installed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturer: Subject to compliance with requirements, provide ceiling panels and grid systems by one of the following:
   1. Concealed and Exposed Suspension Grid:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corporation.
      c. Chicago Metallic; Rockfon (Roxul Inc.).
      d. Hunter Douglas.
      e. USG Interiors.
   2. Acoustical Ceiling Panel:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corporation.
      c. Rockfon (Roxul Inc.).
      d. Tectum Inc.
      e. USG Interiors.
   3. Molding and Edge Trim:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corp.
      c. Chicago Metallic Corporation.
      d. Fry Reglet Corporation.
      e. Gordon, Inc.
      f. USG Interiors, Inc.; Subsidiary of USG Corporation.
   4. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation; SHEETROCK Acoustical Sealant.
   5. Acoustical Sealant for Concealed Joints:
      a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
      b. Pecora Corporation; AIS-919.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 METAL SUSPENSION SYSTEM

A. Metal Suspension System: Direct hung metal suspension systems of types, structural classifications, and finishes indicated complying with applicable requirements in ASTM C 635/C 635M.
   1. High Humidity Finish: Comply with ASTM C 635/C 635M requirements for Coating Classification for Severe Environment Performance where high humidity finishes are indicated.
   2. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1 Direct Hung, unless otherwise indicated. Comply with seismic design requirements.

a. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
   1) Type: Cast in place, postinstalled expansion or postinstalled bonded anchors.
   2) Corrosion Protection: Carbon steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
   3) Corrosion Protection: Stainless steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
   4) Corrosion Protection: Components fabricated from nickel copper alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

b. Power Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

3. Wire Hangers, Braces, and Ties:
   a. Zinc Coated, Carbon Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   b. Stainless Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
   c. Nickel Copper Alloy Wire: ASTM B 164, nickel copper alloy UNS No. N04400.
   d. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1 Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 inch (2.69 mm) diameter wire.
4. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust inhibitive paint.
5. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04 inch (1 mm) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16 inch (8 mm) diameter bolts.
6. Hold Down Clips: Provide hold down clips spaced 24 inches (610 mm) o.c. on all cross tees in areas with exterior opening larger than 48” x 96”.
7. Impact Clips: Provide impact clip system designed to absorb impact forces against acoustical panels in Gymnasiums.
8. Aluminum cap for use over steel grid in kitchen areas or where shown on drawings or required.

B. Metal Suspension Systems:
1. Wide Face, Steel Capped, Double Web, Steel Suspension System: Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16 inch (24 mm) wide metal caps on flanges.
   a. Structural Classification: Heavy duty system.
   b. Face Design: Flat, flush.
   c. Cap Finish: Color selected by Architect.
2. Narrow Face, Steel Capped, Double Web, Steel Suspension System: Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished, cold rolled, 9/16 inch (15 mm) wide metal caps on flanges.
   a. Structural Classification: Intermediate-duty system.
   b. Face Design: Flat, flush.
   c. Cap Finish: Color selected by Architect.

2.3 ACOUSTICAL CEILING SYSTEMS

A. ACS-1:
   1. Color: White.
   2. Size: 15/16 inch.
   3. Material: Steel.
   4. Grid: 2 feet by 2 feet.

B. ACS-2:
   1. Color: Black.
   2. Type: Exposed.
   3. Size: 15/16 inch.
   4. Material: Steel
   5. Grid: 2 feet by 2 feet.

2.4 ACOUSTICAL PANELS

A. Acoustic Panel ACT-1:
   1. Basis of Design Product: School Zone Fine Fissured No. 1713 by Armstrong World Industries.
   2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern:
      a. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
      b. Pattern: CE (perforated, small holes and lightly textured).
   3. Color: White.
   4. LR: Not less than 0.85.
   5. NRC: Not less than 0.65.
   6. CAC: Not less than 35.
   7. Edge/Joint Detail: Square.
   8. Thickness: 3/4 inch (19 mm).
   9. Modular Size: 24 by 24 inches (610 by 610 mm).
   10. Humidity/ Sag Resistance: The resistance of interior coatings to mold and mildew growth is useful in estimating the performance of coatings designed for use in interior environments that promote mold growth and in evaluating compounds that may inhibit such growth and the aggregate levels for their use when tested according to ASTM D 3273.
   11. Typical Location: Refer to Drawings.
   12. Suspension: Exposed.

B. Acoustic Panel ACT- 2:
   1. Basis of Design Product: Clean Room 868 by Armstrong World Industries.
   2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern:
      a. Type and Form: Type IV, mineral base with membrane faced overlay; washable vinyl film overlay.
      b. Pattern: GH (smooth and printed).
      c. Color: As indicated on Drawings.
   3. LR: Not less than 0.65.
   4. CAC: Not less than 40.
   5. Edge/Joint Detail: Square.
   6. Thickness: 5/8 inch (15 mm).
   7. Modular Size: 24 by 24 inches (610 by 610 mm).
   8. Humidity/ Sag Resistance: The resistance of interior coatings to mold and mildew growth is useful in estimating the performance of coatings designed for use in interior environments that promote mold growth and in evaluating compounds that may inhibit such growth and the aggregate levels for their use when tested according to ASTM D 3273.
   9. Typical Location: Refer to Drawings.

C. Acoustic Panel ACT-3:
1. Basis of Design Product: Optima 3152 High NRC by Armstrong World Industries
2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern:
   a. Type and Form: Type IV.
   b. Pattern: E (lightly textured).
   c. Color: As indicated on Drawings.
3. Perforated: No.
4. LR: Not less than 0.88.
5. NRC: Not less than 0.75.
6. Edge/Joint Detail: Square.
7. Thickness: 1 inch (25 mm).
8. Modular Size: 24 by 24 inches (610 by 610 mm).
9. Humidity/ Sag Resistance: The resistance of interior coatings to mold and mildew growth is useful in estimating the performance of coatings designed for use in interior environments that promote mold growth and in evaluating compounds that may inhibit such growth and the aggregate levels for their use when tested according to ASTM D 3273.
10. Typical Location: Refer to Drawings.

D. Acoustic Panel ACT-4:
1. Basis of Design Product: School Zone Fine Fissured No. 1713 by Armstrong World Industries.
2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern:
   a. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
   b. Pattern: CE (perforated, small holes and lightly textured).
3. Color: Black
4. LR: Not less than 0.85.
5. NRC: Not less than 0.65.
6. CAC: Not less than 35.
7. Edge/Joint Detail: Square.
8. Thickness: 3/4 inch (19 mm).
9. Modular Size: 24 by 24 inches (610 by 610 mm).
10. Humidity/ Sag Resistance: The resistance of interior coatings to mold and mildew growth is useful in estimating the performance of coatings designed for use in interior environments that promote mold growth and in evaluating compounds that may inhibit such growth and the aggregate levels for their use when tested according to ASTM D 3273.
11. Typical Location: Refer to Drawings.
12. Suspension: Exposed, Tech Black.

E. Acoustic Panel ACT-5:
1. Basis of Design Product: Box Series - Linear. as manufactured by Certainteed.
2. Perforation: 0.06 inch diameter.
3. Size: 96 inches by 6 inches.
4. Color: Decorated (Powder Coat) Wood Look: Light Pecan.
5. Suspension: Concealed.
6. Acoustical Infill: 1.5 inches , Polywrapped Fiberglass.

2.5 MOLDING, TRIM AND ACCESSORIES

A. Shadow Molding: Where an acoustical lay in ceiling abuts a gypsum board ceiling in the same plane, provide a "W" shaped reveal or "shadow" molding similar to Armstrong Shadow Molding No. 7873.

B. Light Fixture Protection:
1. Manufacturer: Thermafiber Light Protection Kit by Owens Corning or Type 5/8 or 3/4 P(S) by Armstrong World Industries.

2. Fire Resistance Rating: Same as ceiling assembly rating.
3. Locations: At fixtures reinstalled in fire rated ceiling assemblies.

C. Roll Formed, Sheet Metal Edge Moldings and Trim: Type and profile for standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color used for exposed flanges of suspension system runners.
1. Provide edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For lay in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

D. Extruded Aluminum Edge Moldings and Trim: Where indicated, provide extruded aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
1. Model: AXIOM Classic as manufactured by Armstrong World Industries.
2. Height: As indicated on Drawings.
3. Color: As indictaed on Drawings.

E. Acoustical Sealant: Comply with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut for compliance with requirements specified that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less than half width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA Ceiling Systems Handbook.
1. Fire Rated Assembly: Install fire-rated ceiling systems according to tested fire rated design.

B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers where required and, if permitted with fire resistance rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast in place hanger inserts, postinstalled mechanical or adhesive anchors, or power actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast in place or postinstalled anchors.

D. Panel Accessibility: Install panels downward accessible by disengaging hinge support rail on one side of panel from the T Bar Flange or optional A Mount rail flange without the use of tools, for access without removal of panel from the ceiling.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
2. For square edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. For reveal edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal edged panels on suspension system members with box shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas with exterior opening larger than 48” x 96”, where required by authorities having jurisdiction, and for fire resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
7. Install clean room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire resistance rated assembly.

3.4 FIRE RATING SCHEDULE

A. A. Refer to UL Assemblies Drawings for Fire Rating requirements of ceiling materials at rated floor and roof assemblies.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
   1. Compliance of seismic design.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
   1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
      a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
      b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 00

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09 54 26 – SUSPENDED WOOD CEILINGS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:
   1. Concealed suspension system for Wood Grille ceiling panels.
   2. Wood Grille ceiling panels for concealed suspension system.
   3. Trim and accessories.
   4. Seismic restraints for suspended ceiling system.

1.2 REFERENCES

A. ASTM A 641: Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire; 1992.
B. ASTM C 423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 1990.
C. ASTMC C 635: Standard Specifications for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
D. ASTM C 636: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 1992.
E. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials; 1991.
F. ASTM E 580: Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint; 1991.
G. AWI (QSI): Architectural Woodwork Quality Standards Illustrated; 2003.
H. CISCA: Ceiling Systems Handbook.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers other than those listed in Paragraph 2.1 are required to submit for approval prior to bidding per Section One.
B. Installer Qualifications: Engage an experienced Installer, approved by wood ceiling manufacturer, who has completed panel ceilings similar in species, design, and extent to that indicated for this Project and with a record of successful in-service performance.
C. Inspection: All work must pass inspection and approval of architect, as well as the local codes and regulations or authorities having jurisdiction.
D. Single-Source Responsibility for Wood Ceiling System: Obtain each type of Wood Grille ceiling panels from a single fabricator, with in-house Shop Drawing capabilities, in-house assembly and finishing capabilities, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.
E. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying project.
F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.4 SUBMITTALS

A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each type of product specified.
C. Samples: For verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the range of variations expected.
    1. 12” x 18” samples of each panel type, pattern, and color.

1.5 SHOP DRAWINGS & COORDINATION WITH OTHER TRADES

A. Shop Drawings: Provide Shop Drawings/Coordination Drawings for all ceilings, which should include RCP and product details. Coordinate Wood Grille ceiling panels layout and installation of wood panels and suspension system components with other construction elements that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, partition assemblies and all perimeter conditions.

1.6 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install wood panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery & Unloading: Coordinate crate sizes, weights, unloading options, and delivery schedule with manufacturer prior to fabrication. Deliver wood panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other mistreatment.
B. Acclimatization: Before installing wood panels, permit them to reach room temperature and a stabilized moisture content (at least 72 hours) per AWI standards.
C. Handling: Handle Wood Grille ceiling panels carefully to avoid chipping edges or damaging units in any way.
D. Protection:
    1. Personnel: Follow good safety and industrial hygiene practices during handling and installing of all products and systems, with personnel to take necessary precautions and wear appropriate protective equipment as needed. Read related literature for important information on products before installation. Contractor to be solely responsible for all personal safety issues during and subsequent to installation; architect, specifier, owner, and manufacturer will rely on contractor’s performance in such regard.
    2. Existing completed work: Protect completed work above suspension system from damage during installation of suspension system components.

1.8 EXTRA MATERIALS/WARRANTIES

A. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
    1. Wood Grille ceiling panels: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
    2. Suspension System Components: Furnish quantity of each component equal to 2.0 percent of amount installed.

B. Warranties: Provide owner with a (1) year warranty for material and workmanship on all installed products.
    1. Manufacturers: All materials, wood ceiling and grid, shall be warranted for (1) one year for material and workmanship.
    2. Installer: All work shall be warranted for (1) year from final acceptance of completed work.

PART 2 – PRODUCTS

2.1 WOOD GRILLE CEILING PANELS AND SUSPENSION SYSTEM

A. General: The following manufacturer is basis of design: 9Wood, Inc. (www.9wood.com): 1200 Dowel Grille. Listed manufactures whose products meet or exceed the specifications are approved for use on the Project.
    1. 9Wood, Inc. (www.9wood.com): 2100 Panelized Linear.
    2. Armstrong World Industries, Inc.
    3. Rockfon (Roxul Inc.).
    4. CertainTeed Wood.
B. Or equal, as prior approved by architect.

2.2 WOOD GRILLE CEILING AND WALL PANELS

A. Basis of Design: 9Wood, Inc., 1100 Series Piece Grille.
    1. Wood Panels (WCS-1):
        a. Species: Western Hemlock.
        b. Member Size: As indicated on Drawings.
        c. Edge Profile: Square.
        d. Members/LF: 4.
        e. Assembly Style: Cross Piece Backer.
        f. Panel Sizes: Nominal size, 1’ x 8’ (Nom).
        g. Fire Rating: Fire Rating Class, e.g., Class 1(A) Fire Rating.
        h. Reveal Scrim: Standard Black.
        i. Finish: Western Hemlock – Custom Stain WC-02754.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal T-Grid Suspension System: Provide standard interior Metal Heavy Duty 15/16” suspension T-Grid system using Main Runners, Cross-tees, Wall Angle or Shadow Moldings of types, structural classifications, and finishes indicated and that comply with applicable ASTM C 635 requirements. Comply with all applicable codes and ordinances.
B. Attachment Devices: Size for 3 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
C. Wire, Braces, Ties, Hanger Rods, Flat Hangers and Angle Hangers: Provide wires, rods and hangers that comply with applicable ASTM specifications.

PART 3 – EXECUTION

3.1 EXAMINATION

A. General: Examine substrates and structural framing to which ceilings attach or abut, with installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Layout: Measure each ceiling area and establish the layout of Wood Grille Panel to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans in accordance with wood ceiling manufacturer’s approved Shop Drawings.

3.3 INSTALLATION

A. General: Install 9Wood, Inc. Interior Wood Grille Style 1100 to comply with manufacturer's instructions and CISCA "Ceiling Systems Handbook."
B. Attachments: Suspend ceiling hangers from building's structural members per manufacturer’s instructions and in compliance with all local codes and regulations.
C. Installation of Metal T-Bar Grid: Install, align, brace, tie-off, mount, handle interferences, and space suspension T-Grid in accordance with suspension manufacturer’s instructions and in compliance with all local codes and regulations.
D. Installation of Wood Grille (Series 1000): Install Wood Grille ceiling panels in accordance with manufacturer’s installation instructions and in compliance with all local codes and regulations. Install with undamaged edges and fitted accurately to suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit, as required.
E. Suspension Runners: Install suspension system runners so they are square and securely interlocked with one another. Install number and use on-center spacing per wood ceiling manufacturer’s instructions, as indicated on approved Shop Drawings and in compliance with all local codes.

3.4 CLEANING

A. General: Clean exposed wood surfaces of 9Wood, Inc. Style 1200 Wood Grille ceiling panels. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace wood ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 54 26

SECTION 09 64 29 - WOOD STRIP AND PLANK FLOORING (STAGE FLOORING)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Masonite stage flooring.

B. Oak apron (Thrust Stage) flooring, with sanding and finishing of flooring.

1.3 RELATED WORK

A. Section 09 91 00 - Paintings and Coatings.

1.4 REFERENCES

A. American Plywood Association (APA).

1.5 SUBMITTALS

A. Product Data:
1. Manufacturer's technical data, specifications and instructions for each type of wood flooring.
2. Manufacturer's storage, installation, and finishing instructions.
3. Manufacturer's maintenance instructions.

B. Samples:
1. Flooring:
   a. Actual sample of specified flooring in adequate size, in specified color and finish for Architect's approval.
   b. 20 inch x 20 inch sample of actual specified flooring in color and finish approved by Architect.
   c. Approved color and finish sample will be basis for which work will be judged.

2. Wall Base:
   a. Six (6) inch long samples of each actual specified wall base in manufacturer's complete color range for Architect's selection and approval.

3. Aluminum Coverplate:
   a. Six (6) inch long samples of actual specified aluminum coverplate at floor transitions in manufacturer's complete color range for Architect's selection and approval.

C. Evidence of installer's qualifications if not manufacturer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing flooring systems of the type specified for this Project, with a minimum of five (5) years experience and approved by manufacturer.

B. Uniformity: To maximum extent possible, obtain flooring materials from one manufacturer to ensure uniformity of quality and color.

C. Verify moisture content of all materials prior to installation and finishing.

D. Installation shall be supervised by Manufacturer's representative.

E. Mockups: Construct mockups to demonstrate aesthetic effects and to set quality standards for installation.
   1. Prepare 6 foot by 6 foot (2 m by 2 m) mockups of typical flooring area in location determined by Architect. Free lay mock up to demonstrate aesthetics of wood planks prior to completing mock up to establish quality and aesthetic standards for sanding, application of field finishes, sealer, and methods of installation.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 CONTRACTOR'S RESPONSIBILITIES

A. As scope and performance documents, the Drawings and Specifications do not necessarily indicate or describe all the work required for the performance and completion of the Work. Contracts will be let on the basis of such documents with the understanding that the Contractor shall furnish and install the items required for proper completion of the Work without adjustment to price or schedule. Work shall be of sound, quality construction and the Contractor shall be solely responsible for the inclusions of adequate labor and materials to cover the proper and timely fabrication and installation of the wood flooring and related work indicated, described, or implied.

B. As a performance specification, the criteria for the solution of structurally sound wood flooring and related work indicated on the Drawings or specified herein are the sole purpose of defining the design intent and performance requirements. The details shown are intended to emphasize the acceptable profiles and performance requirements for this Project. To avoid any misunderstanding or lack of interpretation, the Contractor is hereby advised that the responsibility for the wood flooring and related work indicated are totally his and that designs and resolutions proposed in the Contractor's shop drawings, structural calculations, and related documentation shall be demonstrated throughout the Work and warranty period specified or required.

C. Design proposal submissions which follow exactly the details indicated on the Drawings, will not relieve the Contractor of his responsibility for the design, fabrication, erection, or performance of the Work of this Section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials until all masonry, plastering, tile, marble and terrazzo work is completed, and overhead mechanical trades and painters have finished in wood floor area.

B. Flooring materials must be allowed to acclimate to building conditions on the job site in a dry, well-ventilated area, not in contact with concrete or masonry.

1.9 PROJECT CONDITIONS

A. The building must be reasonably dry and all openings must be closed in.

B. Permanent heat, light and air conditioning shall be installed and operating a week prior to, during and after installation, maintaining a temperature range of 65 degrees F to 75 degrees F. Humidity conditions within the building shall approximate humidity conditions which will prevail when building is occupied, but shall not be allowed to fall below 35 percent or be higher than 50 percent.

1.9 WARRANTY

A. Warrant the work specified herein for three (3) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to the following:
   1. Shrinking, warping, cracking, or deteriorating excessively.
   2. Becoming loose from substrate.
   3. Failure due to unusual exposure to moisture or other abusive forces or elements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.
   1. Stage and Apron (Thrust Stage) Materials, except for Tempered Pressboard Stage Flooring:
      a. Action Floor Systems, LLC.; (800) 746-3512.
      b. Connor Sports; (800) 833-7144.
      c. Horner Flooring Co.; (906) 482-1180.
      d. Robbins Sports Surfaces; (800) 543-1913.
      e. Sherman Lumber Company; (800) 464-6220.
      f. Superior Floor Company; (715) 842-5358.

   2. Tempered Pressboard Stage Flooring:
      a. Masonite Architectural; (877) 332-4484.

2.2 STAGE MATERIALS

A. Vapor Barrier Materials: Six (6) mil polyethylene film.

B. Cushion Pads: 1/2 inch thick x 4 inches wide x 4 inches long, neoprene rubber with 50 Durometer as recommended by the flooring manufacturer.

C. Subfloor: 4 feet-0 inch x 8 feet-0 inch x 3/4 inch thick, fire retardant, C-D grade, Douglas Fir or Southern Yellow Pine plywood. (Two (2) layers)

D. Flooring: 4 feet-0 inch x 8 feet-0 inch x 3/16 inch thick “Duron WR Tempered Pressboard Floor Underlayment” (Masonite) as manufactured by Masonite Corp. No substitutions.

E. Fasteners: Staples of type, size and finish recommended by the flooring manufacturer to suit application. Other fasteners, if any, shall be of type, size and finish recommended by the flooring manufacturer to suit application.

F. Finishing Materials: Sealer and paint as recommended by the flooring manufacturer with black non-gloss, non-slip finish.

2.3 APRON (THRUST STAGE) MATERIALS

A. Vapor Barrier Materials: 6 mil polyethylene film.

B. Cushion Pads: 1/2 inch thick x 4 inches wide x 4 inches long, neoprene rubber with 50 Durometer as recommended by the flooring manufacturer.

C. Subfloor: Two (2) layers 15/32 inch thick 4 feet x 8 feet, APA rated, 4-ply plywood sheeting, exposure 1.

D. Flooring: 3/4 inch thick x nominal 1-1/2 inch wide x random lengths, Red Oak, with matching solid stock for trim.

E. Fasteners: Machine-driven fasteners of type, finish, and size recommended by floor manufacturer to suit application.

F. Finishing Materials: Stain and Durawax finish in color as selected by Architect from manufacturer's standard colors.

2.4 MISCELLANEOUS MATERIALS

A. Tape: Two (2) inch wide duct tape or type recommended by manufacturer for sealing vapor barrier edges.

B. Mastic and Primer: As recommended by flooring manufacturer.

C. Felt: 15 lb. asphalt-saturated felt.

D. Cleaning Solvent: Cleaner-degreaser as recommended by flooring manufacturer.

E. Wall Base: Vented type in size recommended by floor manufacturer, in color selected by Architect.

F. Coverplates: Three (3) inch x one (1) inch continuous extruded aluminum plate as recommended by flooring manufacturer in color selected by Architect from manufacturer's standard colors.

2.5 EXTRA STOCK

A. At completion of work, deliver and store at site as directed by Architect not less than two (2) percent of the quantity of Masonite flooring material installed for Owner's future replacement.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect concrete slab for proper tolerance and dryness, and report any discrepancies to the General Contractor for correction. Do not begin work until discrepancies are corrected.

B. Beginning work shall mean acceptance of existing conditions.

3.2 PREPARATION

A. General: Moisture content of flooring shall not exceed eight (8) percent during installation. In regions with constant high humidity moisture content shall not exceed ten (10) percent.

B. General Contractor shall:
   1. Provide a concrete slab subfloor, with adequate moisture barrier beneath and at the perimeter of the slab.
   2. Provide proper and accurate slab depression to receive flooring system.
   3. Provide smooth troweled and level slab to a tolerance of 1/8 inch in a 10 feet-0 inch radius.
   4. Provide concrete slab in acceptable condition by grinding down high areas and filling low areas with approved leveling compound.
   5. Clean concrete slab of all debris so flooring contractor will have adequate access to work surface.

3.3 STAGE FLOORING INSTALLATION

A. Vapor Barrier: Cover concrete slab with vapor barrier, lapping edges a minimum of six (6) inches and tape to seams in place. Turn vapor barrier up three (3) inches minimum.

B. Install subfloor in two (2) layers with 1/4 inch spacing all edges and all joints staggered in both directions. Each layer's joints staggered from the other. Provide one (1) inch expansion voids at perimeter and all vertical obstructions. Bottom layer of plywood shall have the cushion pads attached to the sheet 24 inches on center and at corners and edges on all sides. Middle layer of plywood shall be attached with staples or other means and at spacing recommended by the manufacturer to suit application.

C. Prepare surface of the stage plywood subfloor by cleaning, drying, and leveling, as required.

D. Install top layer of flooring (Masonite) in a staggered joint pattern with rows starting with one (1) piece centered at the front edge of the stage. Allow 1/32 inch gap at all joints. Install flooring with screen (rough) side down. Install one (1) staple centered in panel, followed by staples in a square pattern 12 inches on center Starting with a staple at the midpoint of each side, working toward the corners, install staples 12 inches on center maximum, 1/2 inch from the edge around the perimeter. Where panels are interrupted by floor boxes attach panels six (6) inches on center around the devices, two (2) staples per side, minimum. Staples are to be set flush with no protruding edges.

3.4 APRON (THRUST STAGE) FLOORING INSTALLATION

A. Vapor Barrier: Cover concrete slab with vapor barrier, lapping edges a minimum of six (6) inches and tape to seams in place. Turn vapor barrier up three (3) inches minimum.

B. Install plywood subfloor in two (2) layers with 1/4 inch spacing all edges and all joints staggered in both directions. Each layer's joints staggered from the other. Provide one (1) inch expansion voids at perimeter and all vertical obstructions. Bottom layer should have the cushion pads attached to the sheet 24 inches on center and at corners and edges of plywood on all sides. Middle layer shall be attached with fasteners or other means and at spacing recommended by manufacturer to suit application.

C. Prepare surface of the stage plywood subfloor by cleaning, drying, and leveling, as required.

D. Install finish flooring parallel with stage by power nailing or stapling approximately 12 inches on center Size joints between flooring strips to allow for intermediate expansion, in accordance with manufacturer's recommendations. Provide one (1) inch expansion voids at the perimeter and at all vertical obstructions.

3.5 ACCESSORY INSTALLATION

A. Install wall base anchored to walls in accordance with manufacturer's instructions.

B. Install aluminum cover plates at finish floor transitions, except at transition of Masonite flooring and finish wood flooring, fastened at 16 inches on center.

3.6 FINISHING - STAGE FLOORING

A. Clean and sweep floor according to manufacturer's recommendations.

B. All outlets and engraved labels in or on floor mounted boxes shall be masked-off.

C. One (1) week prior to Owner's occupancy, floor and spare Masonite panels shall receive two (2) coats of sealer/paint applied with a napped roller to create a non-glossy, non-slip surface. Color shall be black.

D. During finishing operation follow manufacturer's recommendations including temperature and ventilation requirements.

3.7 FINISHING - APRON (THRUST STAGE) FLOORING

A. Clean and sweep floor according to manufacturer's recommendations.

B. Finish with one (1) coat stain and wax finish as recommended by manufacturer. Color shall be as selected by Architect from manufacturer's standard colors.

C. During finishing operation follow manufacturer's recommendations including temperature and ventilation requirements.

3.8 CLEANING AND PROTECTION

A. Remove debris caused by Work of this Section and clean and sweep floor according to manufacturer's recommendations.

B. As soon as floor is dry, cover with non-staining drop cloths to keep footprints, construction dust, and caster marks from defacing finished surface. Remove drop cloths when so directed.

END OF SECTION 09 64 29

SECTION 09 64 66 - WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wood athletic flooring.
   2. Subflooring.
   3. Sleepers.
   4. Resilient cushioning.
   5. Sheet vapor retarder.
   6. Floor finishes.
   7. Surface finishing.

B. Related Sections:
   1. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
   2. Section 03 30 00 - Cast-in-Place Concrete: Concrete subfloor surface; recessed.
   3. Section 03 30 00 - Cast-in-Place Concrete03 30 00 - Cast-in-Place Concrete: Formed depressions for deep floor sockets and inserts.
   4. Section 06 10 00 - Rough Carpentry: Subfloor blocking.
   5. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
   6. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
   7. Section 09 90 00 - Painting and Coating: Product requirements for surface finish materials for application in this section.
   8. Division 26 - Electrical: Electrical floor cover plates.

1.3 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

D. ASTM F2772 - Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems; 2011 (Reapproved 2019).

E. DIN EN 14904 - Surfaces for Sports Areas – Indoor Surfaces for Multi-Sports Use – Specification; 2006.

F. MFMA (PUR) - Performance and Uniformity Rating Sport Specific Standards; current edition.

G. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems; current edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data for flooring, floor finish materials, and resilient cushion.

C. Shop Drawings: Indicate floor joint pattern and termination details.
   1. Indicate provisions for expansion and contraction, wall base, and game insert or socket devices.
   2. Indicate size and type fasteners and anchors.
   3. Indicate location, size, design, and color of game markings.

D. Samples: Submit two samples 12 inches 12 inches in size showing floor finish, color, and sheen.

E. Test Reports: Submit test reports showing compliance with DIN EN 14904.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Manufacturer's Instructions: Indicate standard and special installation procedures.

H. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

I. Manufacturer's qualification statement.

J. Installer's qualification statement.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Flooring Material:10 square yards (9 sq m) matching installed flooring.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
   1. Minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products specified in this section.
   1. Minimum three years of documented experience.

1.7 MOCK-UPS

A. Refer to Section 01 40 00 - Quality Requirements for additional requirements.

B. Construct mock-up of wood athletic flooring including subflooring, resilient cushioning, and wood flooring. Illustrate final finish and include example of painted game lines.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials and store off the floor in a well-ventilated, weather-tight space.

1.9 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and permanent heat and air conditioning is installed and operating.

B. Maintain room temperature between 55 degrees F (13 degrees C) and 75 degrees F (24 degrees C) and relative humidity between 35 to 50 percent for a period of seven days prior to delivery of materials to installation space, during installation, and after installation.

C. Acclimate wood flooring materials to installation space a minimum of 48 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience

manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. Wood Athletic Flooring:
    a. Aacer Flooring: www.aacerflooring.com/#sle.
    b. Action Floor Systems; Action Anchor Flex: www.actionfloors.com/#sle.
    c. Connor Sports Flooring: www.connorfloor.com/#sle.
    d. Grid; Click Wood: www.builtbygrid.com/#sle.
    e. Robbins Sports Surfaces: www.robbinsfloor.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 WOOD ATHLETIC FLOORING

A. General: Wood athletic flooring, system components provided by single manufacturer.
1. Performance Stage System Description:
    a. Basis of Design: Pro Forma II Floor System as manufactured by Connor Sports.
    b. Fixed, cushioned sleeper with subfloor system, wood strip flooring.

2.3 COMPONENTS

A. Wood Strip Flooring:
1. Provide MFMA grade-marked flooring, stamped as manufactured by MFMA member mill.
2. Species: Laylite Maple, kiln dried; tongue and groove edges, end matched.
3. Grade: Second and better.
4. Cut: Edge grain.
5. Moisture Content: 7 to 9 percent.
6. Thickness: 25/32 inch (20 mm).
7. Width: 2-1/4 inches (57 mm).
8. Length: Random, minimum of 9 inches (230 mm).

B. Sleepers:
1. Length: 48 inches (1200 mm).
2. Softwood lumber, 2 by 4 inch (50 by 100 mm) nominal.
3. Plywood, 7/8 inch by 4 inch (22 mm by 100 mm) nominal.

C. Subflooring: Two layers of 15/32 inch (12 mm) thick plywood, APA rated, exposure 1, minimum span rating of 32/16.

D. Channels: Galvanized steel, manufacturer's standard size and shape for system indicated.

E. Resilient Cushioning: Manufacturer's standard rubber pads, factory-applied to bottom side of sleepers.

F. Vapor Retarder: Polyethylene sheet, 6 mil (0.15 mm) thick; 2 inch (50 mm) wide tape for sealing sheet seams.

G. Fasteners and Anchors: Manufacturer's standard type and size to suit application.

2.4 FINISHES

A. Floor Finishes: Types recommended by flooring manufacturer and complying with MFMA specifications.
1. Sealer: Oil based urethane.
2. Finish Coats: Oil based urethane; high gloss.
3. Game Marking Paint: Compatible with sealer and finish coats; colors as indicated on drawings.

2.5 ACCESSORIES

A. Ballet Bars:
1. Basis of Design: Floor-Mounted Double Ballet Barriers as manufactured by Harle
2. Wood Type: Maple.
3. Floor Brackets: Metal Substrate.

a. Color: Black.

B. Transition Strip: Same species and finish as flooring material; profiles indicated.

C. Adhesives: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that concrete subfloor surface is smooth and flat to plus or minus 1/4 inch in 10 feet (6 mm in 3 m).

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
2. Follow moisture and alkalinity remediation procedures in Section 09 05 61 - Common Work Results for Flooring Preparation.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare substrate to receive wood flooring in accordance with manufacturer's and MFMA instructions.

B. Vacuum clean substrate.

3.3 INSTALLATION

A. Place vapor retarder over concrete surface, overlap seams a minimum of 6 inches (150 mm) and seal with tape.

B. Resilient Underlayment: Install in accordance with manufacturer's instructions.

C. Sleepers with Plywood Subfloor:
1. Place sleepers at 90 degree angle to direction of finished floor; space 12 inches (300 mm) on center. Stagger end joints a minimum of 24 inches (610 mm).
2. Anchor sleepers to concrete substrate with steel anchoring pins.
3. For floating applications, do not secure sleepers to structure.
4. Fasten plywood subfloor over sleepers at 45 degree angle to direction of finished floor. Allow minimum 1/4 inch (6 mm) between plywood subfloor edges.
5. Fasten solid lumber subfloor over sleepers at 45 degree angle to direction of finished floor; space as indicated on Drawings.

D. Double Layer Plywood Subfloor:
1. Place first layer at 45 degree angle to direction of finished floor, resilient pad side down.
2. Fasten second layer (without pads) at 45 degree angle to first layer.
3. Allow 1/4 inch (6 mm) between plywood subfloor edges.

E. Install solid blocking at doorways, under stacked bleachers, under locations of heavy equipment, and as shown on drawings, in accordance with flooring manufacturer's recommendations.

F. Wood Flooring:
1. Install in accordance with manufacturer's and MFMA instructions.
2. Lay flooring parallel to length of main playing area. Blind nail or staple to subfloor.
3. Install edge strips at unprotected or exposed edges, and where flooring terminates.
4. Provide 2 inch (24 mm) expansion space at walls and other interruptions.

G. Finishing:
1. Mask off adjacent surfaces before beginning sanding.

2. Sand flooring to smooth even finish with no evidence of sander marks. Remove dust by vacuum.
3. Apply finishes in accordance with floor finish manufacturer's and MFMA instructions.
4. Apply one sealer coat and three finish coats.
5. Apply first coat, allow to dry, then buff lightly with recommended pad to remove irregularities. Vacuum clean and wipe with damp, lint-free cloth before applying succeeding coats.
6. Apply game lines/markers in accordance with layout indicated on drawings.
7. Apply last coat of finish.

3.4 CLEANING

A. Clean floor surfaces in accordance with floor finish manufacturer's instructions.

3.5 PROTECTION

A. Prohibit traffic on finished floor for 72 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION 09 64 66

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SECTION 09 64 69 - WOOD GYMNASIUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Provide gymnasium flooring, with sanding and finishing of flooring at each area, game lines, and accessories to complete work as shown on drawings or required.

1.2 RELATED WORK

A. Section 03 30 00 - Cast-in-place Concrete

B. Section 06 10 00 - Rough Carpentry

C. Section 11 66 23 - Gymnasium Equipment; floor inserts

1.3 REFERENCES

A. American Plywood Association (APA)

B. Maple Flooring Manufacturers Association, Inc. (MFMA)

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer’s technical data, specifications and instructions for each type of wood flooring.
   2. Manufacturer’s storage, installation, and finishing instructions.
   3. Manufacturer’s maintenance instructions.

B. Shop Drawings: Submit gym floor court game line layout, and floor insert locations for Architect’s approval.

C. Samples:
   1. Flooring:
      a. Samples of specified flooring in adequate size, in manufacturers complete color and finish range, for Architect’s selection and approval.
      b. 12 inch by 12 inch sample of actual specified flooring in color and finish selected and approved by Architect.
      c. Approved color and finish sample will be basis for which work will be judged.

   2. Wall Base:
      a. Six (6) inch long samples of each actual specified wall base in manufacturer’s complete color range for Architect’s selection and approval.

   3. Aluminum Coverplate:
      a. Six (6) inch long samples of actual specified aluminum coverplate at gymnasium floor transitions in manufacturer’s complete color range for Architect’s selection and approval.

D. Evidence of installer's qualifications if not manufacturer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing flooring systems of the type specified for this Project, with a minimum of five (5) years experience and approved by manufacturer.

B. Uniformity: To maximum extent possible, obtain flooring materials from one manufacturer to ensure uniformity of quality and color.

C. Verify, document and notify architect of moisture content of all materials prior to installation and finishing. Moisture content of maple and plywood must comply with Manufacturers guidelines given the geographical area and job sight conditions prior to installation.

D. Before starting installation verify, document and notify architect of moisture content of concrete slab. Do not commence with installation if concrete slab exceeds 4.5 pounds per 1000 square feet. Calcium Chloride tests are to be done in accordance with ASTM. Correction of substrate moisture issues and additional testing shall be the responsibility of the General Contractor.

E. Manufacturer's representative shall be notified prior to commencement of flooring installation, and offered the opportunity to visit the site during flooring installation to supervise and provide training if requested by the Contractor, Manufacturer, Owner, or Architect.

1.6 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 – Project Management and Coordination.

1.7 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials until all masonry, plastering, tile, marble and terrazzo work is completed, and overhead mechanical trades and painters have finished in wood floor area.

B. Flooring materials must be allowed to acclimate to building conditions on the job site in a dry, well-ventilated area, not in contact with concrete or masonry, seven (7) days minimum prior to final placement.

1.8 PROJECT CONDITIONS

A. General Contractor is to provide the following: The building must be dry and all openings must be closed in. Permanent heat, light and air conditioning shall be installed and operating a week prior to, during and after installation, maintaining a temperature range of 65 degrees F to 75 degrees F. Humidity conditions within the building shall approximate humidity conditions which will prevail when building is occupied, but shall not be allowed to fall below 35 percent or be higher than 50 percent.

1.9 COORDINATION

A. Verify and coordinate concrete slab depression prior to pouring of slab to ensure appropriate height determined by manufacturer and flooring system provided.

B. Coordinate Work of this Section with work built-in or penetrating flooring, such as inserts (sleeves) for volleyball equipment, etc. as indicated on the Drawings or as noted herein.

1.10 WARRANTY

A. Warrant the work specified herein for three (3) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to the following:
   1. Shrinking, warping, cracking, chipping, splitting, or deteriorating excessively.
   2. Becoming loose from substrate.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.
   1. Wood Flooring:
      a. Action Floor Systems, LLC., Mercer, WI; (“ActionCush” with Airtech resilient pads).
      b. Bauer Sport Floor. 713-939-0157.
      c. Connor Sports Flooring Corporation, Amasa, MI; (“Rezill Panel” with Rezill pads).
      d. Horner Flooring Co., Dollar Bay, MI; (“Thrust-A-Cushion” panel system with Thrust-A-Cushion pads).
      e. Robbins Sports Surfaces, Cincinnati OH (BioCushion with BioSportII pads).
      f. Texas Sports Equipment, LLC, 832-795-9316.
      g. Aacer Flooring, Peshtigo, WI (AacerCush II), 877-582-1181.

2.2 MATERIALS

A. Flooring: 25/32 inch thick by 2-1/4 inches wide, northern hard maple Second & Better within the main basketball court boundaries, and Third and Better northern hard maple outside of the main basketball court boundaries; continuous tongue and groove, end-matched, RL or FJ kiln dried, MFMA grade marked.

B. Sub-floor: two continuous layers of engineered 3-ply (minimum) 15/32 inch (4 feet by 8 feet) APA structural rated plywood sheathing, CDX Exterior Grade, stapled and adhered together with construction adhesive.

C. Resilient Cushion/Pads: 3/8 inch high, EPDM, (polyurethane, natural rubber, or Architect’s approved equivalent; durometer for primary use as basketball court with multi-use capabilities as instructed by manufacturer. PVC is not acceptable.

D. Vapor Barrier: Refer to Section 03 30 00 – Cast In Place Concrete.

E. Fasteners:
   1. Subfloor: One (1) inch length with 7/16 inch crown, coated staples as recommended by the manufacturer.
   2. Flooring: Two (2) inch barbed cleats or 15 gauge coated staples as recommended by the manufacturer.

F. Wall Base: Three (3) inch by Four (4) inch vented cove base with premolded outside corners, color: Black.

G. Finish:

1. Sealer: One (1) coat oil modified polyurethane sealer and finish.
2. Game Line Paint: Oil type paint compatible with floor finish in colors scheduled on drawings or selected by Architect. Smooth finish.
3. Finish: Three (3) coat oil modified polyurethane finish, as recommended by MFMA and manufacturer. Total finish shall match Architect's approved sample.

H. Accessories:
1. Adhesive: Type recommended by manufacturer to adhere layers of plywood subfloor.
2. Tape: 4 inch wide type recommended by manufacturer for sealing vapor barrier edges.
3. Floor inserts (sleeves): See Section 11 66 23 – Gymnasium Equipment, of types shown on drawings or required.
4. Continuous Extruded Aluminum Threshold/Sill Plates: C/S Group, Div. of Conspec Systems, Inc., Muncy, PA (717) 546-5941 ("Model No. GYMF"), or equal by Pemko Manufacturing Co., or National Guard Products, Inc, (NGP); of size and shape as indicated on drawings or required.

2.3 EXTRA STOCK

A. Replacement Material: At completion of work, deliver and store at site as directed by Architect not less than two (2) percent of the quantity of wood flooring material installed.

PART 3 - EXECUTION

3.1 CONCRETE SLAB PLACEMENT

A. Concrete subfloors on or below grade shall be adequately waterproofed beneath and at the perimeter of the slab and on the earth side of below grade walls by general contractor. Sand-poly-sand slab construction is not an acceptable construction. Provide under slab vapor barrier per section 03 30 00 – Cast-in-Place Concrete.

B. General Contractor is to provide concrete slab in acceptable condition by grinding down high areas and filling low areas with approved leveling compound.

C. Acceptable concrete tolerance: 1/8 inch in 10 foot radius, steel troweled.

D. Inspect concrete slab for proper tolerance, dryness, and depression, and report any discrepancies for correction.

E. Do not begin work until discrepancies are corrected.

3.2 PREPARATION

A. General Contractor is to clean concrete slab of all debris so flooring contractor will have adequate access to work surface.

B. Commencement of work shall mean acceptance of existing conditions.

3.3 INSTALLATION

A. General: Moisture content of flooring shall not exceed eight (8) percent during installation. In regions with constant high humidity moisture content shall not exceed ten (10) percent.
B. Vapor Barrier: Cover concrete slab with vapor barrier, lapping edges a minimum of six (6) inches and sealing with adhesive or tape.

C. Subfloor:
   1. Install cushion pads at 12 inches on center on underside of lower plywood subfloor, as required by manufacturer.
   2. Install the lower plywood subfloor perpendicular to the intended floor finish direction. All joints to be staggered and spaced 1/4 inch apart.
   3. Install the upper plywood subfloor diagonal to the lower subfloor panels staggering joints and spacing 1/4 inch apart. Secure these panels using adhesive and 1 inch staples placed 6 inch on center at panel perimeter and 12 inch on center throughout field interior.
   4. Machine nail maple finish flooring with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Provide two (2) inch expansion voids at the perimeter and at all vertical obstructions.

D. Finish Flooring:
   1. Install finish flooring in accordance with MFMA and manufacturer's instructions.
   2. Machine nail finish flooring.
   3. End joints must be properly driven up and proper spacing provided for the humidity conditions of the area as recommended by the installer.
   4. Provide two (2) inch expansion voids at the perimeter and at all vertical obstructions.
   5. Provide 1/16" expansion rows every 2' or 1/64 milled expansion at every board.

E. Floor inserts (sleeves):
   1. Install per manufacturers instructions in locations indicated or required. Finish plate to be installed after floor finishing to provide flush, recessed plate with no jagged or offset edges.

3.4 FLOOR SANDING

A. Sanding shall be in accordance with MFMA and manufacturer's procedures.

B. Machine sand with coarse, medium and fine paper to a smooth, even and uniform surface.

C. Remove sanding dust from entire surface by tack or vacuum.

3.5 FINISHING

A. Inspect entire area of floor to insure that surface is acceptable for finishing, completely free from sanding dust and perfectly clean.

B. Apply one (1) coat of sealer and three (3) coats of finish in accordance with MFMA and manufacturer's instructions.

C. Buff and clean floor between each coat.

D. Paint game lines as shown on drawings or required, between sealer and first coat of finish.

3.6 ACCESSORIES

A. Install base anchoring to walls with base cement or screws and anchors in accordance with manufacturer's instructions. Neatly miter inside corners. Use pre-molded outside corners.

B. Install coverplates at floor finish transitions in accordance with manufacturer's instructions.

3.7 MAINTENANCE

A. Upon completion of floor installation, the Owner's maintenance staff, responsible for the upkeep of the building, is to be trained in the proper care and maintenance of the flooring in accordance with instructions of the MFMA and manufacturer.

END OF SECTION 09 64 69

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Resilient sheet flooring.
   2. Installation accessories.

B. Related Sections:
   1. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
   2. Division 26: Electrical floor cover plates for installation of resilient flooring specified in this section.

1.3 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Verification Samples: Submit two samples, 6 by 6 inch (150 by 150 mm) in size illustrating color and pattern for each resilient flooring product specified.

D. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 78 23 - Operation and Maintenance Data for additional provisions.
   2. Extra Flooring Material: Provide extra flooring material equal to 1 percent of each type and color of installed flooring, minimum of 10 square feet (1 square meters).

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Do not double stack pallets.

1.7 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are acceptable for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 BASIS OF DESIGN

A. Products as indicated on Drawings.

2.3 GENERAL REQUIREMENTS

A. Unless noted otherwise, all Resilient Flooring shall comply with the following:
   1. VOC Content Limits: As specified in Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Surface Texture: As indicated on Drawings.
   4. Pattern: As indicated on Drawings.
   5. Color: As indicated on Drawings

2.4 RESILIENT TILE FLOORING

2.5 RESILIENT TILE FLOORING

A. General Requirements

B. General Requirements
   1. Size(s): As indciated on Drawings.
   2. Size(s): As indciated on Drawings.

C. Vinyl Composition Tile - RFT-1,2,3,4, 5: Homogeneous, with color extending throughout thickness.

D. Vinyl Composition Tile - RFT-1,2,3,4, 5: Homogeneous, with color extending throughout thickness.
   1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:
   2. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:
      a. Armstrong Flooring: www.armstrongflooring.com/#sle.
      b. Armstrong Flooring: www.armstrongflooring.com/#sle.
      c. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      d. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      e. Tarkett: www.tarkett.com/#sle.
   3. Basis of Design: Standard excelon Imperial Texture as manufactured by Armstrong Flooring
   4. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   5. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   6. Thickness: 0.125 inch (3.2 mm).
   7. Thickness: 0.125 inch (3.2 mm).

8. Size: 12 inches by 12 inches.
9. Color: Architect to select from manufactuer's full range.

2.6 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Adhesive for Vinyl and Rubber Flooring:
   1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:
      a. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
      b. Loba-Wakol, LLC: www.loba-wakol.com/#sle.
      c. Stauf USA, LLC: www.staufusa.com/#sle.

D. Moldings, Transition and Edge Strips:Refer to .
   1. Metal Moldings, Transition and Edge Strips: Refer to Section 05 77 00 - Decorative Extruded Metal.
   2. Resilient Moldings, Transition and Edge Strips: Refer to Section 09 65 13 - Resilient Base and Accessories.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive coved base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

F. Install flooring in recessed floor access covers, maintaining floor pattern.

3.4 INSTALLATION - TILE FLOORING

3.5 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

C. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern unless noted otherwise.

D. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern unless noted otherwise.

E. Install tile in pattern indicated on Drawings. Allow minimum 1/2 full size tile width at room or area perimeter.

F. Install tile in pattern indicated on Drawings. Allow minimum 1/2 full size tile width at room or area perimeter.

3.6 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.7 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 65 00

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes
   1. Resilient base, adhesive attached, in locations shown on drawings.
   2. Resilient subfloor transitions.

1.3 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to demonstrate compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Samples:
   1. Actual samples or color charts showing manufacturer’s full range of colors, for Architect’s selection (if selections are not already scheduled or otherwise indicated on the drawings).
   2. Actual 12-inch-long piece of base material in each color selected for approval.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed, whose product meets or exceeds the specifications are approved for use on the Project with Architect’s approval. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Burke Flooring.
   2. Flexco.
   3. Johnsonite.
   4. Mannington.
   5. Nora Rubber Products.
   6. Roppe Corp.
   7. Tarkett.

2.2 MATERIALS

A. Standard Rubber Base (typical except where extended toe or other type of base is specifically indicated on drawings, e.g., at athletic flooring or elsewhere) (RB-1, RB-2):
   1. Quality Standard: ASTM F1861.
   2. Material: Rubber, vulcanized, Type TS, Group I, Styles A and B. Vinyl base and Type TP are not acceptable.
   3. Manufacturing Method: Group I (solid, homogeneous)
   4. Style: Topset cove; rolls of greatest length available, cut to length required to minimize joints.
   5. Minimum Thickness: Full 1/8 inch (3.2 mm)
   6. Color(s): As scheduled or otherwise indicated on the drawings, or if not so indicated, as selected by Architect.
   7. Height: 4 inches, unless indicated otherwise
   8. Corners: Job-Formed.

9. Basis of Design: Products as manufactured by Burke Flooring, Flexco, Johnsonite, Nora Rubber Products, or Roppe Corp.

B. Stair Treads (RSR):
1. Usage: For use at interior stairs, as indicated on Drawings
2. Type: Stair treads for the visually impaired..
3. Thickness: 1/8 inch.
4. Size: Largest sizes available as required for installation.
5. Material: Rubber or vinyl as recommended by manufacturer to suit application.
6. Color(s): As select from Manufactuer's full range. .
7. Manufacturers: Burke Flooring, Flexco, Johnsonite, Mohawk, Roppe, Tarkett, or Architect approved equal.
8. Basis of Design: Rubber Treads with Kevlar as manufactured by Roppe Corp.

C. Adhesive: Rubber-based type; same brand as base or as recommended and approved by base manufacturer to suit application.

D. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation.

2.3 EXTRA STOCK

A. Deliver to Owner:
1. percent, or one (1) unopened carton of each color, type and size of base selected, whichever is greater.
2. One (1) gallon container of each type adhesive used for base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which Work of this Section will be performed. Report unsatisfactory conditions to Architect in writing. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Prepare substrates to receive base as recommended by base manufacturer.

B. Verify substrates are smooth and ready to receive resilient base. Grind high spots and fill low spots with latex cementitious filler as required.

C. Starting Work indicates acceptance of existing conditions.

3.3 INSTALLATION

A. General:
1. Install materials only after finishing operations, including painting, have been completed and after permanent heating and cooling system is operating.
2. Verify that moisture content of concrete slabs, building air temperature, and relative humidity are within the limits recommended by the manufacturers of the materials used.

B. Installing Base:
1. Install base where shown on the Drawings in accordance with manufacturer’s instructions.
2. Use factory-preformed exterior corners, and factory preformed or job-mitered interior corners, as indicated on the drawings or directed by Architect.

3.4 CLEANING AND PROTECTING

A. Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

END OF SECTION 09 65 13

SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fluid-applied polyurethane flooring over rubberized base mat.
   2. Rubber sheet flooring, adhesively installed.

B. Related Requirements:
   1. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.3 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

B. DIN EN 14904 - Surfaces for Sports Areas – Indoor Surfaces for Multi-Sports Use – Specification; 2006.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.

D. Selection Samples: Manufacturer's color charts for flooring materials specified and game line paints, indicating full range of colors and textures available.

E. Verification Samples: Actual flooring material specified, not less than 12 inch (305 mm) square, mounted on solid backing.
   1. Include samples of game lines, illustrating colors selected.

F. Test Reports: Submit test reports showing compliance with DIN EN 14904.

G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

H. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

I. Manufacturer's Instructions: Indicate standard and special installation procedures.

J. Installer's qualification statement.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Flooring Material: 10 square yards (9 sq m) matching installed flooring.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

C. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.8 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F (21 to 35 degrees C) for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F (10 degrees C) or to go above 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.1 PREFORMED ATHLETIC FLOORING

A. All products by the same manufacturer.

B. Acceptable Manufacturers:
   1. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
      a. Burke Flooring: www.burkeflooring.com/#sle.
      b. Dinoflex Group: www.dinoflex.com/#sle.
      c. Grid: www.builtbygrid.com/#sle.
      d. LG Hausys America, Inc; : www.lghausysusa.com/#sle.
      e. No Fault Sport Group: www.nofault.com/#sle.
      f. Pawling Corporation: www.pawling.com/#sle.
      g. Robbins Sports Surfaces: www.robbinsfloor.com/#sle.
      h. Regupol.
      i. Tarkett Sports: www.tarkettsportsindoor.com/#sle.
      j. Ultimate RB: www.ultimaterb.com/#sle.
      k. U.S. Rubber Recycling, Inc: www.usrubber.com/#sle.
   2. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

C. Rubber Sheet Flooring: Two-layer vulcanized rubber (PRA1, 2, 3):
   1. Thickness: Minimum 7 mm.
   2. Size: 6'-6" by 85'.
   3. Durometer Hardness, Type A: Minimum of 75, when tested in accordance with ASTM D2240.
   4. Color: As indicated on drawings.
   5. Products:
      a. OmniSport HPL7 as manufactured by Tarkett.

D. Rubber Sheet Flooring: Two-layer vulcanized rubber (PRA-4,5,6):
   1. Thickness: Minimum 6.2 mm.
   2. Size: 6'-6" by 85'.
   3. Durometer Hardness, Type A: Minimum of 75, when tested in accordance with ASTM D2240.
   4. Color: As indicated on drawings.
   5. Products:
      a. OmniSport Multi-Use as manufactured by Tarkett.

2.2 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

A. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius (1/1000).

B. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

C. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Resilient Sheet Flooring:
   1. Unroll flooring and allow to relax before beginning installation.
   2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
   3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
   4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
   5. Weld seams using techniques and equipment recommended by manufacturer.
   6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
   7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.

3.4 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.5 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION 09 65 66

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SECTION 09 67 00 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Fluid-applied, epoxy resin flooring system.
   2. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
   2. Section 07 92 00 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

1.3 REFERENCE STANDARDS

A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2018.

B. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).

C. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

G. Texas Accessibility Standards (TAS) - 2012 Texas Accessibility Standards (TAS); 2012.

1.4 DEFINITIONS

A. Refer to Section 01 42 16 - Definitions for the following terms:
   1. Comparable Product.

1.5 SUBMITTALS

A. Product Data: Technical data for each type of product indicated include manufacturer's technical data, application instructions, and recommendations for each flooring component required.

B. Samples: Submit flooring system required, 6 inches (150 mm) square, applied to a rigid backing.
   1. Two samples indicating range of slip resistant textures
   2. Two samples of actual color and texture selected by Architect.

C. Reports and Certificates:
   1. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Maintenance Data: Submit data for flooring system to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements of the IBC for interior floors.

2. Fire Test Response Characteristics: Determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
3. Accessibility Requirements: Comply with applicable requirements.
   a. Texas Accessibility Standards (TAS).
4. Flammability: Self-extinguishing according to ASTM D635.

B. Installer Qualifications: Installer having minimum 5 years documented experience in the installation of epoxy floors and who is a manufacturer authorized representative trained and approved for installation of flooring systems required. Engage installer certified in writing by floor manufacturer as qualified to apply flooring systems indicated.

C. Source Limitations: Obtain primary flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

D. Pre-Installation Conference: Conduct conference at site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.9 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full year from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. BASF Corporation; Construction Systems:
   2. Crossfield Products Corp.:
   3. Sherwin-Williams Company (The), General Polymers.
   4. Sika Corporation; Flooring.
   5. Stonhard Group (The):

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 FLUID-APPLIED, EPOXY RESIN FLOORING SYSTEM (FF-7)

A. Basis of Design: "Resuflor Deco Quartz BC23" manufactured by Sherwin-Williams Company.

B. System Characteristics:

1. Base: 1/8" Decorative Broadcast Epoxy Flooring System, as manufactured by Sherwin-Williams, consists of 3579 Standard Primer / Binder as the primer, 3561 Epoxy Resin Glaze as the binder resin, 5900F ESTES Colored Quartz Aggregate, and 3746 Self-Leveling Epoxy as the grout.
2. Seal Coat:3746 Self-Leveling Epoxy.
3. Color and Pattern: As selected by Architect from manufacturer's full line.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Remove existing floor covering, adhesives, and contaminates. Ensure existing concrete floor is ready to receive epoxy floor covering.
   2. Roughen concrete by Shot Blasting (mechanical preparation only) substrates complying with manufacturer's written instructions.
   3. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
   4. Verify that concrete substrates are dry and moisture vapor emissions are within acceptable levels according to manufacturer's written instructions.
      a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab area in 24 hours.
      b. Plastic Sheet Test: ASTM D4263. Proceed with application after testing indicates absence of moisture in substrates.
      c. Relative Humidity Test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
   5. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
   1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

D. Epoxy Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer/Waterproofing Membrane: Apply primer or waterproofing membrane over entire substrate surface in manufacturer's recommended thickness.
   1. Apply to integral cove base substrates.

C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Do not broadcast into cove. Mix quartz aggregates and add thixotropic and hand trowel. Round internal and external corners.

D. Quartz Granules: Broadcast Quartz into Undercoat. Scrape off and vacuum up excess aggregate.

E. Topcoats: Trowel or squeegee apply clear epoxy resin coat topcoats indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

3.3 CURING

3.4 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

3.5 CLEANING

A. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION 09 67 00

SECTION 09 68 00 - CARPETING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Carpet and pad.
   2. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 SUBMITTALS

A. Product Data: Technical data including installation recommendations for each type of substrate:
   1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Samples: For each products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12 inch (300 mm) square Sample from approved color and product of carpet.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.
   3. Carpet Seam: 6 inch (150 mm) Sample.
   4. Mitered Carpet Border Seam: 12 inch (300 mm) square Sample. Show carpet pattern alignment.
   5. Carpet base and accessory samples.

C. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.

D. Shop Drawings: Showing extent of product, seam direction, and location and type of carpet accessories. Submittal to indicate columns, doorways, enclosing walls or partitions, casework, and locations where cutouts are required.

E. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for the IBC for interior finishes.
   2. Fire Test Response Characteristics: Provide products with the critical radiant flux classification determined by testing identical products in accordance with ASTM E 648. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
   3. Accessibility Requirements: Comply with applicable requirements.
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).

b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
c. Texas Accessibility Standards (TAS).

B. Installer Qualifications: Installer having minimum 5 years documented experience as a commercial carpet installer, who is certified by the International Certified Floorcovering Installers Association at the Commercial II or higher certification level.

C. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

B. Store in a dry location between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally, elevated above slab level on a flat surface, stacked no higher than two rolls.

C. Store materials in area of installation for minimum period of 48 hours prior to installation.

D. Protect carpet from damage, dirt, stains, and moisture.

1.7 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet and carpet cushion until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 COORDINATION

A. Contractor’s responsibility to hire movers to move furniture as required for flooring installation. Coordinate with Owner and Architect regarding temporary furniture relocation.

1.9 WARRANTY

A. Carpet: Written warranty in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excessive surface wear, excess static discharge, and delamination.
3. Warranty Period: 25 years from date of Substantial Completion.

1.10 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 – Project Management and Coordination.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design Manufacturer: Tarkett; (800) 248-2878. Other manufacturers are subject to compliance with requirements:
1. Bentley Mills; (800) 423-4709.
2. Interface, LLC; (800) 634-6032.
3. J&J Flooring Group; (800) 241-4586.

4. Milliken & Company.
5. Mohawk Group.
6. Patcraft.
7. Shaw Contract Group.
8. Tarkett.

B. Carpet:
1. Basis of Design:
   a. (CP1, CP2): Create Space as manufactured by Tarkett.
2. Performance:
   a. Appearance Retention Rating: Severe traffic, 3.5 minimum according to ASTM D 7330.
   b. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
   c. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
   d. Delamination: Not less than 4 lbf/in. (18 N/mm) per ASTM D 3936.
   e. Tuft Bind: Not less than 5 lbf (22 N) according to ASTM D 1335.
   f. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
   g. Resistance to Insects: Comply with AATCC 24.
   h. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
   i. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
   j. Antimicrobial Activity: No antimicrobials (EPA Registered pesticides) added to product (ASTM E2471-05).
   k. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
   l. Emissions: Provide carpet that complies with testing and product requirements of CRI Green Label Plus.
   m. Backing: Standard with manufacturer.
3. Face Construction:
   a. Width: Six (6) feet.
   b. Construction: PatterneLoop.
   c. Gauge: 5/64.
   d. Stitches per Inch: 10.0.
   e. Pile Height Average: 0.187 inch.
   f. Tuft Density: 128.
   g. Cushion Roll Goods (RS), Total Weight: 81.0 ounces per square yard.
   h. Fiber Content: SD Nylon.
   i. Dye Method: Solution Dyed.
4. Basis of Design: Powerbond Cushion Backing System by Tandus.
   a. Primary Tufting Substrate: Synthetic nonwoven.
   b. Fusion Coat: Sealant Vinyl.
   c. Backing: Closed-Cell Vinyl Cushion
      1) Weight: 35.5 ounces per square yard.
      2) Density: 18.5 lbs. per cubic foot.
      3) Thickness: 5/32 inch.
      4) Compression Set: Maximum 10 percent.
      5) Compression Deflection:
         (a) Maximum 7 lbs. per square inch at 25 percent.
         (b) Maximum 25 lbs. per square inch at 25 percent.
   d. Adhesive System: Microencapsulated Tackfier applied to 100 percent during manufacturing.
5. Total Product Weight: RS 83.0 ounces per square yard plus or minus 5 percent. Product Testing Information:

a. Surface Flammability: Passes CPSC FF-1-70. (ASTM D2859)
b. Flooring Radiant Panel: Class 1 (mean average CRF: 0.45 watts per square centimeter or higher. (ASTM E648)
c. Electrostatic Propensity: 3.0 kV or lower. Permanent Conductive Fiber. (AATCC 134)
d. Color(s):
    1) CP1: Inclusive 32811
    2) Cp2: Bedstone 772004
    3) Accent: Nigh Thunder 60911.
e. Locations: Refer to Drawings.

C. Carpet (CP3) (Walk-Off):
1. Basis of Design Product/Manufacturer: “Assertive Action II” as manufactured by Tarkett; (800) 248-2878.
2. Type: Patterned carpet tiles.
3. Construction: Accuweave® Patterned Loop
4. Color(s): As selected by Architect from manufacturer’s extended color line.
5. Locations: As shown on drawings.

D. Applied Soil Resistance Treatment: Standard with manufacturer.

E. Antimicrobial Treatment: Standard with manufacturer.

F. Adhesives: Water resistant, mildew resistant, nonstaining, pressure sensitive type to suit products and subfloor conditions indicated, complying with flammability requirements for installed carpet and is recommended by carpet manufacturer for releasable installation.

G. Trowelable Leveling and Patching Compounds: Latex modified, hydraulic cement based formulation provided or recommended by carpet cushion manufacturer.

H. Adhesives: Water resistant, mildew resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

I. Seam Adhesive: Hot melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

J. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

K. Extra Carpet: After completion of the carpet installation, the carpet subcontractor shall provide an additional three (3) percent of total yards installed of each carpet specified to the Owner for future carpet replacement that may be required. This extra stock is to be unused rolls, tiles, and mats and does not include scraps.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet and cushion manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 30 00 for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Comply with CRI 104, Section 7.3 Site Conditions; Floor Preparation and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet and cushion manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet and carpet cushion manufacturer written installation instructions for the following:
   1. Direct Glue Down Installation: Comply with CRI 104, Section 9 Direct Glue Down Installation.
   2. Stair Installation: Comply with CRI 104, Section 13 Carpet on Stairs for glue down installation.

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
   1. Do not bridge building expansion joints with carpet.
   2. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
   3. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

D. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, Patterned Carpet Installations and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform cleaning operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, Protecting Indoor Installations.

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer.

END OF SECTION 09 68 00

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SECTION 09 72 00 - WALL COVERINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Secftion Includes:
   1. Surface preparation and prime painting.

B. Related Sections:
   1. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

A. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 6 by 6 inch (150 by 150 mm) in size illustrating color, finish, and texture.

E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Wall Covering Materials: 25 linear feet (8 linear m) of each color and pattern of wall covering; store where directed.
   3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 MOCK-UP

A. Provide panel, 3 panel drops wide, full height, illustrating installed wall covering and joint seaming technique.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.1 WALL COVERINGS

A. Acceptable Manufacturers:
   1. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
      a. Acoustic Ceiling Products: www.acpideas.com/#sle.
      b. ATI Decorative Laminates: www.atilaminates.com/#sle.
      c. Koroseal/RJF International: www.koroseal.com/#sle.
      d. MDC Wallcoverings: www.mdcwall.com/#sle.
      e. Momentum Textiles & Wallcovering: www.momentumtextilesandwalls.com/#sle.
      f. Wolf-Gordon: www.wolfgordon.com/#sle.
   2. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Basis of Design: Products as indicated on Drawings.

C. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

D. Wall Covering - Type WC1-3: Fabric-backed vinyl roll stock.
   1. Basis of Design:Insight as manufactured by Koroseal.
   2. Comply with ASTM F793/F793M, Category V, Type II.
   3. Total Thickness: .025 inches.
   4. Total Weight: 20 oz.
   5. Roll Width: 52 Inches - 54 Inches.
   6. Backing: Woven, osnaburg fabric.
   7. Color(s): As indicated on Drawings .
   8. Pattern: As indicated on Drawings.
   9. Pattern Match: As indicated on Drawings.
   10. Repeat: As indicated on Drawings.
   11. Surface Texture: As indicated on Drawings.
   12. Overcoating: Manufacturer's standard coating for stain resistance.

E. Magnetic Writeable Wall Covering:
   1. Basis of Design: M248-00 as manufactured by Walltalkers and WriteMAGNETIC 48" as manufactured by WriteWalls. Other acceptable manufactuer's include Koroseal or an Architect apporved equal.
   2. Surface Gloss: Matte Finish.
   3. Laminate Thickness: 24 mils (0.61 mm).
   4. Width: 48 inches.
   5. Backing: Woven Polyester.
   6. Stain Resistant Coating: Scotchguard by 3M Co. or Tedlar by
   7. Flammability Testing Class A: Pass.

8. Color: White.

F. Wall Covering - Type WC 5: Fabric-backed vinyl roll stock.
1. Basis of Design: Insight as manufactured by Koroseal.
2. Comply with ASTM F793/F793M, Category V, Type II.
3. Total Thickness: .025 inches.
4. Total Weight: 20 oz.
5. Roll Width: 52 Inches - 54 Inches.
6. Backing: Woven, osnaburg fabric.
7. Color: As indicated on Drawings .
8. Pattern: As indicated on Drawings.
9. Pattern Match: As indicated on Drawings.
10. Repeat: As indicated on Drawings.
11. Surface Texture: As indicated on Drawings.
12. Overcoating: Manufacturer's standard coating for stain resistance.

G. Wall Covering - Type WC 6: Fabric-backed vinyl roll stock.
1. Basis of Design: Desert Sand as manufactured by Koroseal.
2. Comply with ASTM F793/F793M, Category V, Type II.
3. Total Weight: 20 oz.
4. Roll Width: 53 Inches - 55 Inches.
5. Backing: Woven, osnaburg fabric.
6. Color: As indicated on Drawings .
7. Pattern: As indicated on Drawings.
8. Pattern Match: Reverse Hang.
9. Repeat: None.
10. Surface Texture: As indicated on Drawings.
11. Overcoating: Manufacturer's standard coating for stain resistance.

H. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

I. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

J. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

3.2 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Marks: Seal with shellac those that may bleed through surface finishes.

F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

F. Butt edges tightly.

G. Overlap adjacent panels as recommended by manufacturer.

H. Horizontal seams are not acceptable.

I. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.

J. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

K. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

L. Cover spaces above and below windows, above doors, in pattern sequence from roll.

M. Apply wall covering to electrical wall plates prior to replacing.

N. Wall covering is required behind fin tube cabinets.

O. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches (150 mm) of wall covering termination. Ensure full contact bond.

P. Install termination trim.

Q. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.5 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION 09 72 00

SECTION 09 81 00 - ACOUSTIC INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fiberglass batt acoustical insulation.
   2. Sprayed cellulose fiber acoustical insulation.)

B. Related Sections:
   1. Section 09 21 16 - Gypsum Board Assemblies: Acoustically-rated partitions.
   2. Section 09 90 00 - Painting and Coating: Painting of spray-applied acoustic insulation.

1.3 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).

D. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).

E. ASTM E759/E759M - Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2023).

1.4 SYSTEMS DESCRIPTION

A. Contractor must use a total system, encompassing equipment, fiber and adhesive as supplied and tested by the manufacturer. No substitution.

B. Fibers supplied under this Section shall have each bag coded with the date and lot number of manufactures and retained samples shall be kept by the manufacturer for not less than 1 year.

C. Contractor must be licensed and trained by the manufacturer.

1.5 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Certification:
   1. Manufacturer's certificate that the product meets or exceeds specified requirements.
   2. Manufacturer's written certification that product contains no asbestos, and that sprayed-cellulose fiber acoustical insulation contains no fiberglass or other man made mineral fibers.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturers.
   2. Suppliers.
   3. Installers/Applicators.

1.7 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in original, unopened containers bearing name of manufacturer, product identification and reference to U.L. testing.

B. Store materials off ground, under cover and away from damp surfaces and keep material dry at all times.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Batt Insulation (Walls and Ceilings):
      a. CertainTeed Corp. (CertaPro AcoustaTherm).
      b. Guardian Fiberglass, Inc. (Thermal & Sound Control Batts).
      c. Johns-Manville (Sound-SHIELD Sound Control Batts).
      d. Knauf (EcoBatt with ECOSE).
      e. Owens-Corning (Above Ceiling – Sonobatts; Walls – Sound Batt).
      f. Thermafiber Sound Attenuation Fire Blanket (SAFB) Insulation.
   2. Spray-Applied Acoustic Insulation:

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 MATERIALS

A. Acoustic Batt Insulation:
   1. Type: ASTM C665, Type 1, unfaced.
   2. Surface Burning Characteristics:
      a. Flame Spread: 25 or less.
      b. Smoke Developed: 50 or less.
   3. Thickness (minimum): As indicated on Drawings.
      a. Auditorium:
         1) Thickness: 3 inches.
         2) Color: Black.
      b. Cafeteria:
         1) Thickness: 1 inch.
         2) Color: Black.
      c. Competition Gymnasium:
         1) Thickness: 1.5 inches.
         2) Color: Custom Color to be selected by Architect at a later date.
      d. Auxiliary Gymnasium:
         1) Thickness: 1.5 inches.
         2) Color: Custom Color to be selected by Architect at a later date.
      e. Practice Gymnasium:
         1) Thickness: 1.5 inches.
         2) Color: Custom Color to be selected by Architect at a later date.
      f. Dance Room:
         1) Thickness: 1.5 inches.
         2) Color: Black.
      g. Multi-Purpose Room:
         1) Thickness: 1.5 inches.
         2) Color: Black.

B. Spray-Applied Acoustic Insulation:

1. Color: Black, unless noted otherwise.
2. Field-tested bond strength report per ASTM E736/E736M: Tested at over 5 years / Not less than 400 psf / Not less than 600 times its weight at one (1) inch
3. Fire Resistance per ASTM E84: Tested at a minimum of five (5) inch thickness, Class I
   a. Flame Spread: Not To Exceed Five (5).
   b. Smoke Development: Not To Exceed Five (5).
4. Sprayed insulation shall meet appropriate Building Code Requirements.
5. Thickness: 1-1/2 inch minimum typical. Thickness shall be determined in accordance with ASTM E605/E605M field test procedure.
6. Bond Deflection per ASTM E759/E759M: 6 inch deflection in 10 foot span - no spalling or delamination.
7. Cohesive Strength at time of application per Method WS-2000: >700 Grams.
8. Basis of Design: “K-13 Spray-On-Systems” manufactured by International Cellulose Corporation.
9. Thickness (minimum) and Color:
   a. Auditorium:
      1) Thickness: 3 inches.
      2) Color: Black.
   b. Cafeteria:
      1) Thickness: 1 inch.
      2) Color: Black.
   c. Competition Gymnasium:
      1) Thickness: 1.5 inches.
      2) Color: Custom Color to be selected by Architect at a later date.
   d. Auxiliary Gymnasium:
      1) Thickness: 1.5 inches.
      2) Color: Custom Color to be selected by Architect at a later date.
   e. Practice Gymnasium:
      1) Thickness: 1.5 inches.
      2) Color: Custom Color to be selected by Architect at a later date.
   f. Dance Room:
      1) Thickness: 1 inch.
      2) Color: Black.
   g. Multi-Purpose Room:
      1) Thickness: 1 inch.
      2) Color: Black.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine all surfaces and report all unsatisfactory conditions in writing to Architect. The work shall not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Provide masking, drop cloths or other satisfactory coverings for all materials/surfaces, which are not to receive insulation to prevent damage from over-spray.

B. Surfaces to receive spray insulation shall be inspected prior to application to determine if priming/sealing is required to insure bonding and/or to prevent discoloration caused by migratory stains. Prime accordingly.

C. Work shall be coordinated with other trades whose work may be affected or have an effect on the installation of the sprayed cellulose fiber.

3.3 INSTALLATION

A. Installation, clean up and curing shall be accomplished according to the manufacturer's recommendations and common construction standards.

B. Provide natural or mechanical ventilation continuously to properly cure the insulation.

3.4 PROTECTION

A. Protect finished installation from damage caused by work of other trades.

END OF SECTION 09 81 00

SECTION 09 84 00 - ACOUSTIC ROOM COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fabric-covered acoustic room components..
   2. Wood-faced acoustic room components.
   3. Pre-assembled wood panels.
   4. Cementitious wood fiber panels
   5. Speaker cloth.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 REFERENCES

A. ASTM C365/C365M - Standard Test Method for Flatwise Compressive Properties of Sandwich Cores; 2016.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

F. ASTM E1111/E1111M - Standard Test Method for Measuring the Interzone Attenuation of Open Office Components; 2014 (Reapproved 2022).

G. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum; 2021a.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Shop Drawings: Show panel joints, detail references, dimensions and methods of attachment.

C. Samples: 12 inch x 12 inch sample of actual material and color charts showing manufacturer's full range of colors for Architect’s selection.

1.5 QUALITY ASSURANCE

A. Provide acoustical panels, diffusers and fabrics of each type required from one (1) manufacturer, of uniform texture and color.

B. Installer. Provide evidence of appropriate experience in system installation and that installation method proposed is acceptable to panel manufacturer.

C. Single Source Responsibility: Obtain acoustical panel materials from a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Carefully protect work during shipment, storage and installation.

B. Deliver materials to job site and store elevated above floor in an enclosed space with proper ventilation and protection from damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed who produce equivalent products to those specified may be used on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
   1. Acoustical Panels:
      a. Acoustical Resources, Inc.
      b. Armstrong World Industries.
      c. Autex Acoustics.
      d. AVL Systems, Inc.
      e. Benton Brothers Solutions, Inc.
      f. Conwed .
      g. Decoustics.
      h. Golterman & Sabo, Inc.
      i. Kirei USA, LLC.
      j. Lamvin, Inc.
      k. MBI Products Company.
      l. Rockfon.
      m. Sky Acoustics.
      n. Sound Concepts.
      o. Wall Technology, Inc.
      p. Frasch.
   2. Fabric Facings:
      a. Guilford of Maine.
   3. Speaker Cloth:
      a. Acoustone Corporation.

2.2 MATERIALS

A. Acoustical Room Components:
   1. Acoustical Room Component (ARC-1, ARC-2, ARC-3): Ceiling Hung Clouds.
      a. Basis of Design: Clouds as manufactured by Frasch.
      b. Color: Refer to Drawings.
      c. Shape: Refer to Drawings.
      d. Size: Refer to Drawings.
      e. Thickness: 2.75 inches.
      f. Corners: Rounded.
      g. Suspension: Sputnik Jointed Griplock.
      h. Installation: As recommended by Manufacturer.
   2. Acoustical Room Component (ARC-6, ARC-7):
      a. Basis of Design: Brik 2.0 as manufactured by Frasch.
      b. Material: 9 mm PET.
      c. Size: Refer to Drawings.
      d. NRC: 0.50.
      e. Finish: Architect to select from Manufacturer's full range.
      f. Flame Spread: Class A, 25 or less in accordance with ASTM E84 .
      g. Installation: As recommended by Manufacturer.
   3. Acoustical Room Component (ARC-8, ARC-9, ARC-10, ARC-12) Fabric-Faced above 7'0"-AF.F.
      a. Basis of Design: Basic Series Acoustical Panel as manufactued by Acoustical Resources, Inc.
      b. Size: Refer to Drawings.
      c. Color: Refer to Drawings.

d. Panel Thickness to be determined by Room:
   1) Panels to be 3 inches thick in Band Hall, Orchestra Room, Choir Room, and all practice ensemble rooms.
   2) Panels to be 4 inches thick in auxiliary music room.
   3) Panels to be 2 inches thick in drama room.
e. Fabric Facing: 100 percent polyester fabric, Guilford of Maine Anchorage - 2335 Series in colors selected by Architect from manufacturer's full range of colors, or approved equal. Finish shall be applied directly to face and edges of the panel and returned onto the back of the panel to provide a full finished edge. All corners shall be fully tailored.

4. Mounting Accessories:
   a. Top Clips and Brackets:
      1) Factory mounted concealed mechanical “Z” clips screw fastened to the back of resin hardened spots on panel at maximum 24 inch on center spacing.
      2) Set clips inboard one (1) to two (2) inches from panel edges.
      3) “Z” clips shall engage on galvanized single or double wall brackets with closed ends to prevent lateral panel movement.
      4) Clips shall be fabric covered if exposed to view.
   b. Bottom: 6 inch hook & loop brackets shall be shimmed on stacked spacer panels to provide even face alignment.
5. Pyramidal Ceiling Diffuser (ARC-11):
   a. Basis of Design: Pyramidal Ceiling Diffuser as manufactured by Acoustical Rescources, Inc.
   b. Size/Location: Refer to Drawings.
   c. Finish: As selected by Architect from manufacturer's full range.
   d. Flame sread: Class A, 25 or less in accordance with ASTM E84.

B. Speaker Cloth:
   1. Vinyl coated fiberglass threads, mildew resistant, Class A fire retardant, in color and texture as selected by Architect from manufacturer’s full line of colors and textures.
   2. Basis of Design: Acoustone Speaker Grille Cloth.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify dimensions to insure proper fabrication of materials.

3.2 INSTALLATION

A. Install wall panels, ceiling diffusers, and fabrics only after all wet work has been completed and temperature conditions approximate conditions when space will be occupied.

B. Install wall panels, ceiling diffusers, and fabrics in accordance with manufacturer's instructions and approved shop drawings.

C. Install Tectum Wall Panels on Natatorium walls with venting space between the wall and panels in accordance with manufacturer’s instructions.

D. Install wall panels, and ceiling diffusers in proper alignment. Shim wall track as necessary to provide a level frame work.

E. Arrange wall panels symmetrically on each wall, unless otherwise indicated, Remove wall panels, ceiling diffusers, and fabrics are damaged and unacceptable to Architect and replace with new undamaged materials at no expense to Owner.

END OF SECTION 09 84 00

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Surface preparation and field painting of exposed items and surfaces.
   2. Field preparation and painting of factory primed metal products and fabrications.
   3. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.

C. ASTM D2486 - Standard Test Methods for Scrub Resistance of Wall Paints; 2017.

D. ASTM D2805 - Standard Test Method for Hiding Power of Paints by Reflectometry; 2011 (Reapproved 2018).

E. ASTM D4828 - Standard Test Methods for Practical Washability of Organic Coatings; 1994.

F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

H. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).

1.4 DEFINITIONS

A. Standard coating terms defined in ASTM D16 apply.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.
   2. Eggshell refers to low sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.
   3. Semi-gloss refers to medium sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.
   4. Gloss refers to high sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

1.5 SUBMITTALS

A. Product Data: Submit technical data and information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   1. Indicate manufacturer's instructions for special surface preparation procedures, substrate conditions requiring special attention.
   2. Material List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification.

B. Samples: Submit for each type of paint system and in each color and gloss of topcoat.

1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide list of material and application for each coat of each sample. Label each sample as to location and application.
3. Submit samples on following substrates for review of color and texture only:
   a. Concrete: Provide two 4 inch square samples for each color and finish.
   b. Concrete Masonry: Provide two 4 inch x 8 inch samples of masonry, with mortar joint in the center, for each finish and color.
   c. Painted Wood: Provide two 12 inch square samples of each color and material on hardboard.
   d. Ferrous and Nonferrous Metals: Provide two 4 inch square samples of flat metal and two 8 inch long samples of solid metal for each color and finish.

C. Product List: Submit list of including each paint system, color, and location of application. Use same product and location designations indicated in Finish Schedule.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to: lead and mercury. Do not use solvents in paint products that contribute to air pollution.
2. Performance and Durability:
   a. ASTM D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications.
   b. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
   c. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
   d. ASTM D4828 Standard Test Method for Practical Washability of Organic Coatings.

B. Applicator Qualifications: A firm or individual having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.

C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.

C. Paint Materials: Store at a minimum of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

D. Handling: Maintain a clean, dry storage area to prevent contamination or damage to materials.

1.8 FIELD CONDITIONS

A. Apply waterborne paints when temperatures of surfaces to be painted and surrounding air are between 50 degrees F and 90 degrees F (10 degrees and 32 degrees C).

B. Do not thin or add water to waterbased paints, including waterbased alkyds.

C. Weather Conditions:
1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
2. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above dew point; or to damp or wet surfaces.

3. Minimum Application Temperatures for Water based Paints: Between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

D. Apply solvent thinned paints when temperatures of surfaces to be painted and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C).
   1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
   2. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

E. Provide lighting level of 80 foot candles (860 lux) measured midheight at substrate surface.

F. Labels: Do not paint over Underwriters Laboratories, Factory Mutual, other code required labels, or equipment name, identification, performance rating, or nomenclature plates.

1.9 WARRANTY

A. Written warranty signed by the manufacturer and the installer in which the manufacture and installer agree to repair or replace paint and primers that fail within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Flaking or delamination of paint with the substrate.
      b. Rust, scale, similar imperfections due to improper surface preparation.
      c. Thinning or watering of paint beyond that considered acceptable of paint manufacturer.
      d. Failure to achieve dry film thickness (DFT) recommended by manufacturer for each coat in a paint system.
      e. Deterioration or loss of color of paint beyond normal weathering.
   2. Warranty Period: One year from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 2 percent, but not less than 1 gallon (3.8 L) of each material and color applied.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Benjamin Moore & Co.: www.benjaminmoore.com/#sle.
   2. Kelly-Moore Paints: www.kellymoore.com/#sle.
   3. The Sherwin-Williams Company: www.sherwin-williams.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 MATERIALS

A. Basis of Specifications: The Sherwin-Williams Company.

B. Subject to compliance with requirements, provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential products are not permitted.

C. Proprietary Names: Paint Schedule is based on a single manufacturer for convenience. Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that named products are required to the exclusion of comparable products of specified manufacturers. Furnish product technical data, including percent solids by weight and volume;

VOC content limits and emissions data; and certificates of performance for comparable paint products of specified manufacturer.

D. Subject to compliance with requirements, provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential products are not permitted.

E. Material Compatibility: Provide each paint system including block fillers, primers, and finish coats, that are compatible with one another and with substrates indicated under conditions of service and application, demonstrated by manufacturer based on testing and field experience.

F. Material Quality: Provide manufacturer's best quality commercial paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint material containers not displaying manufacturer's product identification will not be acceptable. Residential quality paint products are not permitted.

G. Chemical Components of Interior Paints and Coatings: Provide products complying with limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and SCAQMD 1113.
   1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Restricted Components: Paints and coatings shall not contain components restricted by the EPA and SCAQMD 1113.

H. Materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

I. Patching Materials: Latex filler compatible with paint systems.

J. Fastener Head Cover Materials: Latex filler.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke to engage the services of a qualified testing agency to sample paint materials.
   1. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to site, samples may be taken at the site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

2.4 PAINT COLOR SCHEDULE

A. Piping in Mechanical Rooms: All exposed piping to be painted in their entirety as follows:
   1. Gas: Orange.
   2. Domestic Cold Water: White.
   3. Domestic Hot Water: Pink.
   4. Heating Hot Water: Red.
   5. Condenser Water: Green.
   6. Chilled Water: Blue.

B. Colors (P-#):
   1. P-1 - Feild:
      a. Manufacturer: The Sherwin-Williams Company.
      b. Color: SW7647, Crushed Ice.
      c. Sheen: Egg Shell.
      d. Locations: All gypsum board ceilings and soffits unless noted otherwise.

2. P-2 - Accent:
    a. Manufacturer: The Sherwin-Williams Company.
    b. Color: SW7044, Amazing Gray.
    c. Sheen: Egg Shell.
    d. Locations: All gypsum board walls unless noted otherwise.
3. P-3 - Accent:
    a. Manufacturer: The Sherwin-Williams Company.
    b. Color: SW7019 Gauntlet Gray.
    c. Sheen: Egg Shell.
    d. Locations: As indicated on Drawings.
4. P-4 - Spirit Color:
    a. Manufacturer: The Sherwin-Williams Company.
    b. Color: SW6886, Invigorate.
    c. Sheen: Egg Shell.
    d. Locations: As indicated on Drawings.
5. P-5 - Spirit Color:
    a. Manufacturer: The Sherwin-Williams Company.
    b. Color: SW9147, Favorite Jeans..
    c. Sheen: Egg Shell.
    d. Locations: As indicated on Drawings.
6. P-6 - Exposed Columns:
    a. Manufacturer: The Sherwin-Williams Company.
    b. Color: SW7069, Iron Ore.
    c. Sheen: Egg Shell
    d. Locations: As indicated on Drawings.
7. P-7 - Exposed Ceiling:
    a. Manufacturer: The Sherwin-Williams Company.
    b. Color: SW6258, Tricorn Black.
    c. Sheen: Egg Shell.
    d. Locations: As indicated on Drawings.
8. P-8 - Collab Entry:
    a. Manufacturer: The Sherwin-Williams Company.
    b. Color: SW6075, Garett Gray.
    c. Sheen: Eggshell.
    d. Locations: As indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content and conditions affecting performance of the work.

B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings.
    1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
        a. Concrete: 12 percent.
        b. Fiber Cement Board: 12 percent.
        c. Masonry (Clay and CMUs): 12 percent.
        d. Wood: 15 percent.
        e. Gypsum Board: 12 percent.
        f. Plaster: 12 percent.
    2. Test cementitious and plaster cement/stucco for alkalinity (pH).

C. Gypsum Board Substrates: Verify taped joints are tapes and finishing compound is sanded smooth.

D. Plaster Substrates: Verify plaster has fully cured. Verify existing plaster is in good condition and can receive new paint coating.

E. Spray Textured Ceiling Substrates: Verify surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
   1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint system consisting of primer and two top coats at a minimum.
      a. Note: Previously painted surfaces have failed to accept new paint systems. Determined cause of failure and take corrective measures to ensure each surface accepts new paint system. Failure of new paint system is not permitted.

G. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator’s acceptance of surfaces and conditions.

3.2 ITEMS TO RECEIVE PAINT

A. Generally, all new items that are normally painted in any typical building, including but not limited to the following list:
   1. All ferrous metal.
   2. All exterior galvanized metal.
   3. All exterior wood.
   4. All interior wood.
   5. All prime coated hardware.
   6. All exposed pipe, plumbing, ductwork, conduit, outlet boxes and electrical cabinets, excluding those located in mechanical rooms.
   7. All metal grilles, except aluminum, unless otherwise indicated.
   8. All exposed gypsum board surfaces, including all mechanical rooms.
   9. Miscellaneous other items which normally require painting or are scheduled to be painted.
   10. Consult plans, finish schedule, details and specifications for other trades as all items usually field painted or finish will be considered as part of the Contract.
   11. All exposed mechanical equipment and electrical equipment.
   12. Traffic lanes and parking spaces including fire lanes and crosswalks.
   13. Rolling doors.
   14. Bollards.
   15. Loose lintels.
   16. Refer to MEP specifications for additional items to receive paint.

B. All work where a coat of material has been applied must be inspected and approved by Architect before application of succeeding specified coat, otherwise no credit for coat applied will be given. Notify Architect when a particular coat has been completed for inspection and approval. Apply coats of material in strict accordance with manufacturer's specifications except where requirements of these specifications are in excess of manufacturer's requirements. Paint all sight exposed pipe and plumbing only after all mechanical work and tests have been completed.

3.3 PREPARATION

A. Coordination of Work: Review work in which primers are provided to ensure compatibility of the total system for various substrates. Notify Architect of anticipated problems when using materials specified over substrates primed by others.
   1. Pre-Primed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or pre-primed substrates.

2. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
3. Correct defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
4. Seal marks which may bleed through surface finishes.

B. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting.
1. Remove hardware and hardware accessories, plates, lighting fixtures, and similar items that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
2. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection if any.
3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
4. Clean and prepare surfaces to receive paint according to manufacturer's written instructions for each substrate condition and as specified. Provide barrier coats over incompatible primers, existing paint or coating, or remove and reprime.
5. Correct defects and clean surfaces affecting bond with paint or coating system. Remove existing coatings exhibiting loose surface defects. Seal marks which may bleed through surface finishes.

C. Cleaning: Before applying paint or surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces.
1. Remove incompatible primers, including factory applied primers, and reprime substrate with compatible primers or apply barrier coat as necessary to produce paint systems indicated.
2. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
3. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
4. Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
5. Aluminum Substrates: Remove surface oxidation.

D. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach. If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.

E. Protective Coverings: Provide protections for duration of the work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.

F. Renovated Surfaces: Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint

system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system.

1. Remove surface film preventing proper adhesion and bond.
2. Wash glossy paint with a solution of sal soda and rinse thoroughly.
3. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
4. Clean corroded iron and steel surfaces.
5. Repair and blend into portland cement plaster.
6. Prime bare surfaces.
7. Tone varnished surfaces with stain bringing to uniform color.
8. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until correcting unsatisfactory conditions.

G. Cementitious Substrates: Prepare concrete surfaces to receive paint. Remove efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

1. Use abrasive blast cleaning methods if recommended by paint manufacturer.
2. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.
    a. Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
    b. Anhydrous Calcium Chloride Test:ASTM F1869 . Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.3 kg of water/92.9 sq. m).
    c. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
    d. Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
    e. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.
3. Clean concrete floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.

H. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

1. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
3. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

I. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

J. Shop Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.

K. Aluminum Substrates: Clean surfaces to remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP-1 Solvent Cleaning. Lightly abrade surface with a nonmetallic pad.

L. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

M. Plaster/Stucco Substrates: Remove contaminants, release agents, curing compounds, efflorescence, chalk, mold, mildew, and similar deterrents. Spot patch existing plaster to eliminate blisters, buckles, excessive crazing, and to check cracking, dryouts, efflorescence, sweat outs, and similar deflects the prevent plaster from bonding with paint or coatings. Sand or texture repair or patch to match adjacent finish and to remove trowel marks and arrises.
1. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
2. Deep Cracks: Clean out and fill deep cracks with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
3. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions. Test for alkali using litmus paper.
4. Allow patching and repair compounds to set and cure before painting.

N. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

O. Wood Substrates:
1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime, stain, or seal wood to be painted. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

P. Pipe Covering and Insulation: Clean to remove loose, foreign, and objectionable material before applying sealing coat.

Q. Preparation of Substrates for Wallcovering: Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate.
1. Assure compatibility with product of wall covering manufacturer.
2. Fill indentations in substrate and prime with opaque white primer before applying release coat.
3. Apply release coat in accordance with manufacturer's recommendations.

R. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.

S. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Do not use thinners for water based paints.
4. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the

finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.4 APPLICATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
   1. The term exposed surfaces includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
   2. Use applicators and techniques suited for paint and substrate indicated.
   3. Provide finish coats compatible with primers.
   4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   5. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces.
      a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
      b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
      c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
   6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   8. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   9. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   10. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
   11. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
   12. Provide finish coats compatible with primers used.
   13. Sand lightly between each succeeding enamel or varnish coat.

B. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

C. Applicators: Apply paints and coatings by brush, roller, spray, or applicators recommended by manufacturer.
   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
   2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool recommended by manufacturer for material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
   1. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.

E. Application: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
   2. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
   3. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
   4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

F. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
   1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
   3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
   4. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
   5. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
   6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
   7. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.

G. Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Painting is limited to items exposed in equipment rooms and occupied spaces.
   1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
   2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
   3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

4. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
5. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

H. Electrostatic Spray Painting: Apply coating electrostatically to finished surfaces, free from runs, sags, visible overlaps, holidays, craters, pinholes and other defects detrimental to protective and decorative qualities of coating.
1. Thickness of Coatings: 1.5 to 2.0 mils dry film thickness. Measure dry film thickness with magnetic gauge.
2. Use application techniques, equipment, materials, and preparation procedures recommended by manufacturer.

I. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.

J. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.

K. Finish Coats: Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through.
1. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
2. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

M. Touch Up: Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated.
1. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
2. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
3. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
4. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.5 FIELD QUALITY CONTROL

A. Dry Film Thickness (DFT) Testing: Tests for dry film thickness may be determined by using a Tooke Scale and microgroover, an electronic scanner, or the Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.6 CLEANING AND PROTECTION

A. It is of the upmost important to the Owner that the sites remain in a safe, clean, and well maintained condition. At the end of each day, leave the site ready to use by staff and students. Protect staff and students and the learning environment throughout the work.

B. Cleanup: At the end of each day, remove empty cans, rags, rubbish, and discarded paint materials from site. After completion of painting work, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide “Wet Paint” signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

E. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.

F. Waste Management: Legally dispose of unused paint and paint containers in accordance with manufacturer’s recommendations and environmental regulations.

PART 4 SCHEDULES

4.1 GENERAL

A. The following is a schedule of typical painted items and does not specifically include every item that is to receive paint but should establish type and quality of finish for all items normally included in a complete paint job.

B. Overhead Painting (Ceilings, Exposed to Structure Above, etc.)
   1. Use a dryfall system comparable to system defined below for substrate.

4.2 SHERWIN-WILLIAMS APPLICATION SCHEDULES

A. Exterior Surfaces: Note: Exterior surfaces are divided into two (2) different categories, based upon color and level of graffiti resistance required. System 1 will be used when standard earthtone colors or neutral colors are specified, and System 2 will be used when bright colors (primary reds, yellows, and oranges) are specified and/or when a graffiti resistant coating is required.
   1. Galvanized Metal:
      a. Surface Preparation: Acid etch galvanized surfaces that have not weathered at least six (6) months prior to beginning painting operations.
      b. Primer: One (1) coat Pro-Cryl Pro Industrial Universal Primer (B66W310)
      c. Finish: Two (2) coats Sher-Cryl HPA High Performance Acrylic (B66W300).
   2. Galvanized Metal: Chloramine environment.
      a. Surface Preparation: Acid etch galvanized surfaces that have not weathered at least six (6) months prior to beginning painting operations.
      b. Primer: One (1) coats Macropoxy 646 (B58-600).
      c. Finish: Two (2) coats Acrolon 218 HS Acrylic Polyurethane (B65-600).
   3. Un-galvanized Metal:
      a. Primer: One (1) coat Pro-Cryl Pro Industrial Universal Primer (B66W310).
      b. Finish: Two (2) coats Sher-Cryl HPA High Performance Acrylic (B66W300).
   4. Pre-Finished Metal Surfaces:
      a. Surface Preparation: As recomme3nded by primer manufacturer.
      b. Primer: One (1) coat Bond-Plex Waterbased Acrylic.
         1) OR
         2) Primer: One (1) coat DTM Bonding Primer.
      c. Finish: Two (2) coats Bond-Plex Waterbased Acrylic.

5. Concrete and CMU:
    a. Primer/Finish: (2) coats Loxon XP Exterior Waterproofing System, 14-18 mils wet, 6.4 – 8.3 mils dry per coat.
6. Tilt-Up Concrete:
    a. Primer: One (1) coat Loxon Concrete and Masonry Primer Sealer (LX02W50), 5.3-8.0 mils wet, 2.1-3.2 mils dry.
    b. Finish: One (1) coat Conflex UltraCrete Acrylic Textured Finish, Texture: Fine, Base Color: CF17W0811 Medium Extra White.
7. Wood (Includes plywood siding and wooden trim):
    a. Primer: One (1) coat A-100 Latex Wood Primer (B42W41).
    b. Finish: Two (2) coats A-100 Acrylic Gloss (A8 ser.).
8. Fiber-Cement Materials:
    a. Primer: One (1) coat Loxon Masonry Primer (A24W300).
    b. Finish: Two (2) coats A-100 Acrylic Gloss (A8 Series).
9. Parking Line and Driveway Paint: Setfast Waterborne Yellow (TM225) (meets Federal Specification (FS) TTP-1952-B)

B. Interior Surfaces:
1. Concrete Substrates, Non-Traffic Surfaces and Clay Masonry:
    a. Latex System:
        1) Prime Coat: Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils (0.203 mm) wet, 3.2 mils (0.081 mm) dry.
        2) Intermediate Coat: Latex, interior, matching topcoat.
        3) Topcoat:
            (a) Flat: ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat.
            (b) Low Sheen: ProMar 200 Zero VOC Latex Low Sheen Eg-Shel, B24-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat.
            (c) Eggshell: ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils (0.102 mm) wet, 1.7 mils (0.043 mm) dry, per coat.
            (d) Semi-Gloss: ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat.
            (e) Gloss: ProMar 200 Zero VOC Gloss, B21-12650 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry, per coat.
    b. Water-Based Light Industrial Coating System:
        1) Prime Coat: Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils (0.203 mm) wet, 3.2 mils (0.081 mm) dry.
        2) Intermediate Coat: Latex, interior, matching topcoat.
        3) Topcoat:
            (a) Eggshell: Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
            (b) Semi-Gloss: Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
2. Concrete Substrates, Pedestrian Traffic Surfaces:
    a. Latex Floor Enamel System:
        1) First Coat: Floor paint, latex, slip-resistant, matching topcoat.
        2) Topcoat: Floor paint, latex, slip-resistant, low gloss: S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils (0.038 to 0.051 mm) dry per coat.
3. Flat: Galvanized Metal:
    a. Latex System:
        1) Prime Coat: One (1) coat Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils (0.127 to 0.254 mm) wet, 2.0 to 4.0 mils (0.051 to 0.102 mm) dry.
        2) Intermediate Coat: Water-based acrylic, interior, matching topcoat.

3) Topcoat:
(a) Semi-Gloss: Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils (0.064 to 0.102 mm) dry, per coat.
(b) Gloss: Pro Industrial Acrylic Gloss Coating, B66-660 Series, at 2.5 to 4.0 mils (0.064 to 0.102 mm) dry, per coat.

b. Water-Based Dry-Fall System:
1) Top Coat:
(a) Flat: S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-181 Series, at 6.0 mils (0.152 mm) wet, 1.5 mils (0.038 mm) dry.
(b) Eggshell: Pro Industrial Waterborne Acrylic DryFall Eg-Shel, B42-82, at 6.0 mils (0.152 mm) wet, 1.9 mils (0.048 mm) dry.
(c) Semi-Gloss: Pro Industrial Waterborne Acrylic DryFall Semi-Gloss, B42-83, at 5.8 mils (0.147 mm) wet, 2.3 mils (0.058 mm) dry.

c. Water-Based Light Industrial Coating System:
1) Prime Coat: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils (0.127 to 0.254 mm) wet, 2.0 to 4.0 mils (0.051 to 0.102 mm) dry.
2) Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3) Top Coat:
(a) Eggshell: Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
(b) Semi-Gloss: Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

4. Shop-Primed Ferrous Metals (Use for metal doors and frames and miscellaneous metal items):
a. Shop coat by others.
b. One (1) coat over Steel Kem Kromik Primer B50series.
c. One (1) coat over Aluminum Metal Procryl Primer B60series.
d. Two (2) coats PM200 Alkyd Semi-Gloss B34series.

5. Wood: (Painted)
a. Latex System:
1) Prime Coat: PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry.
2) Intermediate Coat: Latex, interior, matching topcoat.
3) Topcoat:
(a) Eggshell: ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils (0.102 mm) wet, 1.7 mils (0.043 mm) dry, per coat.
(b) Semi-Gloss: ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat.
(c) Gloss: ProMar 200 Zero VOC Gloss, B21-12650 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

b. Water/Alkyd Urethane System:
1) Prime Coat: Premium Wall & Wood Primer, B28W8111, at 4.0 mils (0.102 mm) wet, 1.8 mils (0.046 mm) dry.
2) Intermediate Coat: Water-based alkyd-urethane, interior, matching topcoat.
3) Topcoat:
(a) Semi-Gloss: Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry, per coat.
(b) Gloss: Pro Industrial Waterbased Alkyd Urethane Gloss, B53-1050 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry, per coat.

c. Water-Based Light Industrial Coating:
1) Prime Coat: PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils (0.102 mm) wet, 1.4 mils (0.036 mm) dry.

2) Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3) Topcoat:
(a) Eggshell: Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
(b) Semi-Gloss: Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

6. Wood: (Stained)
a. Stain: SherWood BAC Wiping Stain (S64 Series).
b. Finish (First Coat): Wood Classics Polyurethane Varnish (A67 Series).
c. Finish (Second Coat): Wood Classics Polyurethane Varnish (A67 Series).

7. Gypsum Board and Plaster:
a. Latex System:
1) Prime Coat: ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils (0.102 mm) wet, 1.0 mils (0.025 mm) dry.
2) Intermediate Coat: Latex, interior, matching topcoat.
3) Topcoat:
(a) Flat: ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat.
(b) Low Sheen: ProMar 200 Zero VOC Latex Low Sheen Enamel, B24-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat.
(c) Eggshell: ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils (0.102 mm) wet, 1.7 mils (0.043 mm) dry, per coat.
(d) Semi-Gloss: ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils (0.102 mm) wet, 1.6 mils (0.041 mm) dry, per coat.
(e) Gloss: ProMar 200 Zero VOC Gloss, B21-12650 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
b. Water-Based Light Industrial Coating System:
1) Prime Coat: ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils (0.102 mm) wet, 1.0 mils (0.025 mm) dry.
2) Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3) Topcoat:
(a) Eggshell: Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.
(b) Semi-Gloss: Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-151 Series, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry, per coat.

8. CMU: (Epoxy) - Kitchens, bathrooms, laboratories, etc.
a. Primer: Two (2) coats Heavy Duty Block Filler (B42W46).
b. Finish: Two (2) coats Water-Based Catalyzed Epoxy (B70/B60).

9. Pipe and fittings, including but not limited to copper and brass, at kitchen areas (but excluding aluminum, stainless steel, nickel and chrome plated pipe and fittings):
a. Primer: One (1) coat; product recommended for the substrate by the finish coat manufacturer.
b. Finish: Two (2) coats bright aluminum paint.

END OF SECTION 09 90 00

SECTION 09 96 23 - GRAFFITI-RESISTANT COATINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes
   1. Preparation, materials, services, and equipment required in conjunction with the application of a graffiti-resistant coating for interior/exterior concrete and masonry surfaces where shown on drawings.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's technical literature, specifications, and application instructions for the specified coating material for Architect's approval.
   2. Manufacturer's application instructions.

B. Samples:
   1. Obtain either liquid or drawn down sample(s) of the specified coating for sample application and Architect's color approval. Sample application is covered in this Section. Approved sample will be basis for which all work will be judged.

C. Certifications:
   1. Applicator's certification of qualifications as specified in Paragraph 1.3, A below.
   2. Manufacturer's certification that coating material to be applied is in conformance with federal, state and local environmental Volatile Organic Compounds (VOC) regulations.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the Work of this Section with minimum three (3) years experience and approved by manufacturer. Provide a list of five (5) most recently completed projects where the coating material was used. Include the project name, location, Architect, and method of application. Applicator shall state the intended use of the proper application equipment and that it has been well maintained.

B. Mock-Up:
   1. Apply coating in accordance with manufacturer's application instructions as directed by Architect to sample panel which matches actual job conditions, including any masonry coatings. Determine best method of application, optimum coverage rate, and number of coats required to produce desired appearance.
   2. After sample treatment has cured in accordance with manufacturer's recommendations, verify the substrate is coated with sufficient material to produce the desired appearance and color.
   3. Obtain Architect's approval of coverage appearance and color prior to full scale application. Approved sample will be basis for which all work will be judged.

C. Pre-Application Meeting: Convene a pre-application meeting prior to the start of application of the specified material. Attendance shall be a representative of the application firm, the Architect, and the material manufacturer. Notify each of the attendees at least three (3) days prior to the meeting time.

1.5 DELIVERY, STORAGE AND PROTECTION

A. Material Delivery: Deliver materials to the job site in original sealed containers, clearly marked with manufacturer's name, brand name, and type of material and color or color formula. Verify the product matches that of the original sample applied on the mock-up wall.

B. Storage and Protection: Store materials inside if possible, away from sparks and open flame. Store in a secure area to avoid tampering and contamination. Water based materials must be kept from freezing. Store and handle according to manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Surface Preparation: Surface must be free of cracks, dirt, oils, paint or other contaminants which may affect the appearance or performance of the coating material.

B. Environmental Requirements:
   1. Air and substrate temperature must be above 50 degrees F or below 95 degrees F unless otherwise specified by manufacturer.
   2. Do not proceed with application if the substrate is wet or contains frozen water.
   3. Do not apply material when rain is predicted within 48 hours; or earlier than five (5) days after the substrate became wet.
   4. Do not apply materials in high or gusty winds.

C. Protection:
   1. Special precautions should be taken to avoid vapor transmission (fumes) from entering the building being treated. Ventilation systems and fresh air intakes should be turned off and dosed.
   2. Protect shrubs, metal, wood trim, glass, asphalt and other building hardware during application from overspray.
   3. Do not permit spray mist or liquid to drift onto surrounding properties.

1.7 SCHEDULING

A. Notify Architect not less than 48 hours before each application of coating is scheduled.

1.8 WARRANTY

A. The contractor and applicator shall jointly and severally warrant anti-graffitti coating material against failure in material and workmanship for a period of five (5) years from the date of application.

B. Submit completed manufacturer's written "Request For Warranty Form" to manufacturer ten (10) days prior to application.

C. After completion of the specified material, submit manufacturer's written "5 Year Warranty Application" to manufacturer for processing. Upon receiving validated warranty, submit copies to Architect and Owner.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of three (3) years experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Prosoco, Inc.
   2. Tnemec.

2.2 BASIS OF DESIGN

A. "Chemprobe: Anti-Grafitti" as manufactured by Tnemec, Inc.

2.3 COATING MATERIAL

A. General: Water Based products shall be 100 percent acrylic. No fillers, extenders, or paraffins. All products shall have a range of 22 percent solids with a minimum of 18 percent acrylic resin.
   1. TECHNICAL CHARACTERISTICS
   2. RESULT / VALUE TEST METHOD
   3. 22 percent ASTM D2369

4. 7.78 lbs/gal (932 g/l) ASTM D1425
5. 5.3 ASTM E398
6. 30 minutes * ASTM D1640
7. Six (6) to eight (8) hours * ASTM D1640
8. Excellent: No deterioration after 3,000 hours
9. 6.2 lbs/gal (743 g/l) EPA #24
10. * Dependent upon weather conditions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify the following:
   1. The required joint sealants have been installed.
   2. New masonry and mortar has cured a minimum of 21 days.
   3. Surface to be treated is clean, dry and contains no frozen water.
   4. Environmental conditions are appropriate for application.

3.2 PREPARATION

A. Protection:
   1. Special precautions should be taken to avoid vapor transmission (fumes) from entering the building being treated. Ventilation systems and fresh air intakes should be turned off and dosed.
   2. Protect shrubs, metal, wood trim, glass, asphalt and building hardware during application from overspray.
   3. Do not permit spray mist or liquid to drift onto surrounding properties or parking lots.

3.3 APPLICATION

A. Apply graffiti-resistant coating in accordance with manufacturer's written application instructions.

B. Apply material as supplied by the manufacturer. Do not dilute or thin.

C. Mix material well just prior to application using a power mixer to assure color uniformity.

D. Material must be applied using the proper application equipment, and the same technique used on the mock-up sample panel.

E. Apply treatment evenly until a uniform color and appearance is achieved.

3.4 FIELD QUALITY CONTROL

A. Contact Architect 48 hours prior to application so as to provide observation as required. The Architect or the Architect's representative shall observe the progress as the work proceeds.

B. After coating has cured (minimum of 12 hours), verify color uniformity. Recoat all areas that are unacceptable.

3.5 CLEANING

A. At completion, remove all excess material, debris, and waste resulting from this work from the job site. Dispose of containers in accordance with state and local environmental regulations.

END OF SECTION 09 96 23

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SECTION 10 01 00 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Furnish and install the following:
   1. Prefabricated Dining Booths.

1.3 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 04 20 00 - Unit Masonry.

C. Section 05 50 00 – Metal Fabrications: Metal bracing, fasteners and other support components.

D. Section 09 21 16 - Gypsum Board Assemblies.

E. Section 09 51 00 - Acoustical Ceilings.

F. Division 26 – Electrical Sections.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.
   3. Manufacturer's operation and maintenance data, as applicable.

B. Shop Drawings: Show sizes, locations and installation details. Include utility (electrical, water, gas) requirements.

C. Samples: Color charts showing manufacturer's full range of colors.

D. PRE-INSTALLATION CONFERENCE

E. Refer to Section 01 31 00 – Project Management and Coordination.

1.5 COORDINATION

A. Coordinate Work of this Section with Work of other sections in which items are to be installed.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Specifications are based on named products and manufacturers. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 MATERIALS

A. Pre-fabricated Dining Booths:
   1. Basis of Design: Martin Brattrud.
   2. Collection: La Purisima.
   3. Type: Banquette, Single Sides.
   4. Upholstery Seat: Momentum Beeline EPU Oriole.
   5. Upholstery Inside and Outside Back: Loom Source Gateway Lazulite.
   6. Recessed Plinth Base: Laminate Black Matte.

B. Tabl at Dining Booths:
   1. Basis of Design: Martin Bratturd.

2. Collection: Niblick, Dining Table.
3. Type: Dining Table 1009-48RD, Rectangle.
4. Size: 48 inches Width, 30 inches Depth, 29.5 inches High.
5. Table Top Material: Plastic Laminate Top, White Matte.
6. Metal Base: Powder Coat, cement - CMT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items fastened to walls have proper blocking or support items installed.

B. Verify locations for items are ready for their installation.

3.2 INSTALLATION

A. Install all items in accordance with manufacturer's printed instructions in locations shown on drawings or otherwise indicated.

3.3 CLEANING AND ADJUSTING

A. Make final adjustment after installation and clean all backstop support piping of dirt and other substances which may affect final finish.

B. Clean all items of dirt and foreign matter which may affect appearance and operation.

C. Adjust items for proper operation.

D. Instruct Owner’s personnel on proper operation and maintenance of items.

END OF SECTION 10 01 00

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Porcelain enamel steel markerboards.
   2. Tackboards.
   3. Aluminum slatwall display units.
   4. Magnetic wwriteable wall covering.

B. Related Sections:
   1. Section 06 10 00 - Rough Carpentry: Blocking and supports.
   2. Section 06 20 00 - Finish Carpentry: Wood frame and marker rails.
   3. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.
   4. Section 09 90 00 - Painting and Coating: Finishing of wood frame and marker rail.
   5. Section 10 22 39 - Folding Panel Partitions: Installation of visual display boards on operable partitions.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

C. ANSI A208.1 - American National Standard for Particleboard; 2022.

D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

E. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

F. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2022.

G. ASTM C1036 - Standard Specification for Flat Glass; 2021.

H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

I. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

L. ASTM F793/F793M - Standard Classification of Wall Coverings and Ceiling Coverings by Use Characteristics; 2025.

M. PS 1 - Structural Plywood; 2009 (Revised 2019).

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's data on chalkboard, porcelain enamel steel markerboard, glass markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Color charts for selection of color and texture of chalkboard, porcelain enamel steel markerboard, glass markerboard, tackboard, tackboard surface covering, and trim.

E. Samples: Two, 2 by 2 inches (50 by 50 mm) in size illustrating materials and finish, color and texture of chalkboard, porcelain enamel steel markerboard, glass markerboard, tackboard, tackboard surfacing, and trim.

F. Test Reports: Show compliance to specified surface burning characteristics requirements.

G. Manufacturer's printed installation instructions.

H. Manufacturer's Qualification Statement.

I. Maintenance Data: Include data on regular cleaning, stain removal.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide five year warranty for chalkboard and markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 VISUAL DISPLAY UNITS

A. Porcelain Enamel Steel Markerboards:
1. Model: LCS3 as manufactured by Claridge.
2. Color: White.
3. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch (0.61 mm).
4. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
5. Backing: Aluminum foil, laminated to core.
6. Size: As indicated on drawings.
7. Frame: Same as for chalkboards.
8. Frame: Extruded aluminum , with concealed fasteners.
9. Frame Profile: As indicated on drawings.
10. Frame Finish: Anodized, natural.
11. Accessories: Provide marker tray and map rail.
12. Manufacturers:
    a. AJW Architectural Products: www.ajw.com/#sle.
    b. ASI Visual Display Products: www.asi-visualdisplayproducts.com/#sle.
    c. Egan Visual Corporation; Egan Visual WhiteBoards: www.egan.com/#sle.
    d. Claridge Products and Equipment, Inc.
    e. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.

B. Tackboards: Fine-grained, homogeneous natural cork.
1. Cork Thickness: 1/8 inch (3 mm).
2. Fabric: Vinyl coated fabric.
3. Color: As selected by Architect from manufacturer's full range.
4. Backing: Hardboard, 1/4 inch (6 mm) thick, laminated to tack surface.
5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
6. Size: As indicated on drawings.

7. Height: 48 inches (1220 mm).
8. Length: As indicated on drawings.
9. Length: 6 feet (1830 mm) , in one piece.
10. Frame: Same type and finish as for chalkboard.
11. Frame: Extruded aluminum , with concealed fasteners.
12. Frame Profile: As indicated on drawings.
13. Frame Finish: Anodized, natural.
14. Accessories: Provide map rail.
15. Manufacturers:
    a. ASI Visual Display Products: www.asi-visualdisplayproducts.com/#sle.
    b. Claridge Products and Equipment, Inc.
    c. Nelson Adams NACO; ____: www.nelsonadamsnaco.com/#sle.

C. Aluminum Slatwall Display Units: Sizes and configurations indicated on drawings.
1. Finish: Anodized, natural.
2. Length: As indicated on Drawings.
3. Frame Profile: As Indictaed on Drawings.
4. Manufacturers:
    a. Eagle Mouldings, Inc; Aluminum Slatwall: www.eagle-aluminum.com/#sle.
    b. Megawall, Inc: www.megawall.com/#sle.
    c. Orange Aluminum: www.orangealuminum.com/#sle.

D. Magnetic Writeable Wall Covering (WRC):
1. Basis of Design: M259-00 as manufactured by Walltalkers and WriteMAGNETIC 60" as manufactured by WriteWalls. Other acceptable manufactuer's include Koroseal or an Architect apporved equal.
2. Surface Gloss: Matte Finish.
3. Laminate Thickness: 24 mils (0.61 mm).
4. Width: 60 inches.
5. Backing: Woven Polyester.
6. Stain Resistant Coating: Scotchguard by 3M Co. or Tedlar by
7. Flammability Testing Class A: Pass.
8. Color: White.

E. Tackable Display Trail (TDR):
1. Economy and Deluxy Map & Display Rail as manufactured by Clardige Products.
2. Size: 2 inches.
3. Surface material: Tan Nucork.

F. Combination Units and Units Made of More Than One Panel: Factory-assembled chalkboards, markerboards, and tackboards in a single frame, of materials specified above.
1. Join panels of different construction with H-shaped extruded aluminum molding finished to match frame.
2. Join panels of similar construction with butt joints, aligned and secured with steel spline concealed in edge of core.
3. Configuration: As indicated on Drawings.
4. Units Too Large to Ship Assembled: Fully assembled in factory, then disassembled for shipping.

2.3 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Hardboard for Chalk Surface: ANSI A135.4 Tempered type.

C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch (0.762 mm) thick, minimum.
3. Ionoplast Interlayer: 0.035 inch (0.889 mm) thick, minimum.

D. Vinyl Coated Fabric: ASTM F793 Category VI.

E. Burlap: Tightly woven, flame retardant treated.

F. Plywood: PS 1 Grade C-D , softwood.

G. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).

H. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

I. Gypsum Board: ASTM C1396/C1396M, paper/foil faced, plain type.

J. Fiber Board: ASTM C208, cellulosic fiber board.

K. Foil Backing: Aluminum foil sheet, 0.005 inch thick (0.13 mm thick).

L. Aluminum Sheet Backing: 27 gauge, 0.014 inch (0.36 mm) thick.

M. Steel Sheet Backing: 28 gauge, 0.0149 inch (0.38 mm), galvanized.

N. Adhesives: Type used by manufacturer.

2.4 ACCESSORIES

A. Wood Frames: Factory assembled red oak, with factory applied clear varnish finish.

B. Wood Frames: Refer to Section 06 20 00 - Finish Carpentry.

C. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall (; 25 mm wide overall) , full width of frame.

D. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.

E. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.

F. Flag Holders: Cast aluminum bored to receive 1 inch (25 mm) diameter flag staff, bracketed to fit top rail of board.

G. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on a metal plate fastened to perimeter frame near chalkrail.

H. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.

I. Marker Tray: Wood; species and finish to match frame, style as indicated on drawings.

J. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

3.2 PREPARATION

A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.

B. Remove switchplates, wall plates, and surface-mounted fixtures where tackable wall paneling is applied. Reinstall items on completion of installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Install with top of marker tray at 30 inches (760 mm) above finished floor.

C. Secure units level and plumb.

D. Butt Joints: Install with tight hairline joints.

E. Carefully cut holes in boards for thermostats.

F. Install tackable wall panels in accordance with manufacturer's recommendations on specified substrates with concealed attachments.
   1. Fabricate re-wrapped edges where partial panels about each other, or adjacent surfaces or trim.
   2. Re-wrap top, bottom or side edges for cutting panels around door or window openings, abutting trim, protruding objects, and at other openings, including x-cut at receptacles, light switches, and other openings.
      a. Wrap minimum 2 inches (51 mm) around back of panel.
      b. Carefully cut fiber board, leaving vinyl wallcovering intact. Wrap wallcovering tightly around edge of board and adhere continuously around back of panel with manufacturer's recommended vinyl wallcovering adhesive.

3.4 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

D. Break-in slate chalkboards with a chalk and clean treatment.

END OF SECTION 10 11 00

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SECTION 10 12 00 - DISPLAY CASES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Recessed display cases.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry : Blocking and supports.

B. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Submit complete printed data and installation details indicating products to be provided as specified.
   1. Submit color charts for selection by Architect.

C. Shop Drawings: Submit complete installation details. Include dimensioned elevations.

D. Samples: Submit samples of material and trim to illustrate finish, color, and texture.

E. Manufacturer's Qualification Statement.

F. Maintenance Data: _____.

G. Specimen Warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver display cases and materials to the Project site with manufacturer’s protective crate covering and do not open until ready for use.

B. Protect display cases before, during, and after installation. In case of damage, immediately provide necessary repairs and replacements.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify field measurements for recessed application for display cases before preparation of shop drawings and before fabrication to ensure proper installation.

1.8 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against defects and in materials, finish product and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Claridge Products and Equipment, Inc: www.claridgeproducts.com/#sle.
   2. MooreCo, Inc: www.moorecoinc.com/#sle.
   3. Nelson Adams NACO: www.nelsonadamsnaco.com/#sle.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 DISPLAY CASES

A. Recessed Display Case: Factory-fabricated wood-framed display case with adjustable glass shelves, finished interior, and aluminum trim on face to cover edge of recessed opening.
   1. Size: As indicated in Drawings.
   2. Components:
      a. Glazed Doors: Sliding.
         1) Number of Doors: Two pair.
      b. Side Panels: Stained veneer plywood.
      c. Back Panel: Tackable.
      d. Top Panel: Stained veneer plywood.
      e. Bottom Panel: Stained veneer plywood.
      f. Lighting: LED backlit.
      g. Size: Refer to Drawings.

2.3 COMPONENTS

A. Wood Case Construction: 3/4 inch (19 mm) 7-ply maple veneer plywood with manufacturer's standard stain.

B. Aluminum Framed Case Construction: 1-1/2 inch by 2 inch (38 mm by 51 mm) extruded aluminum tube frame with tempered glass, laminate-faced, and stained veneer plywood infill panels.

C. Aluminum Case Construction: Aluminum side, bottom, and top panels fabricated from extruded aluminum shapes.

D. Face Frame Trim for Recessed Installation: 2 inch (51 mm) flat face dimension extruded aluminum trim mitered with corner clips and mechanical fasteners.

E. Glazed Sliding Doors:
   1. 1/4 inch (6 mm) clear tempered glass with plastic finger pulls.
   2. Door track: Extruded aluminum glass shoe with bottom rollers and top plastic guide.
   3. Lock: Glass door cylinder lock.

F. Glazed Hinged Doors:
   1. 1/4 inch (6 mm) clear tempered glass framed with 1/2 inch by 1 inch (13 mm by 25 mm) extruded aluminum trim.
   2. Hinges: 1 inch by .040 inch (25 mm by 1 mm) nickel-plated steel-continuous piano hinges.
   3. Lock: Glass door cylinder lock.

G. Glass Shelves:
   1. 1/4 inch (6 mm) clear tempered glass with flat-polished edges.
   2. Shelf Depth: 6 inches (152 mm).

3. Shelves per Unit: Two.

H. Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in 1 inch (25 mm) increments along entire length of standard, drilled and countersunk for screws.
1. Standards Mounting: Recess-mounted into back panel.
2. Face Width: 5/8 inch (16 mm).
3. Material: 16 gauge, 0.0598 inch (1.52 mm) sheet steel.
4. Lengths: As indicated on drawings.
5. Finish: Anochrome.
6. Brackets: Boltless with lip front; 16 gauge, 0.0598 inch (1.52 mm) sheet steel, reinforced, locking into slots; size to suit shelves; same finish as standards.

I. Tackable Back Panel: Fine-grained, homogeneous natural cork on hardboard.
1. Cork Thickness: 1/8 inch (3 mm).
2. Fabric: Vinyl fabric; minimum fabric weight: 13 oz/sq yd (440 g/sq m).
3. Color, Texture, Weave, and Pattern: As selected from manufacturer's full range.
4. Backing: Hardboard, 1/4 inch (6 mm) thick, factory laminated to tack surface.
5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

J. Laminate Back Panel: Low-pressure laminate on one face of plywood substrate.
1. Laminate Color and Texture: As selected from manufacturer's full range.

K. Lighting: Manufacturer's standard LED light fixture housed at top of case with louvered aluminum access door with keyed lock.
1. Surface Mounted: Under cabinet type fixture.
2. Recessed: Fixture with egg crate diffuser.
3. Controls: On/Off using dedicated wall switch.

2.4 MATERIALS

A. Aluminum Extrusions for Framing and Trim: Alloy as recommended by manufacturer for construction and specified finish; nominal 1/8 inch (3.2 mm) wall thickness.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.
1. Finish: Factory anodized; AAMA 611: Clear anodized.
2. Finish: Factory finished; AAMA 2603: Powder coat; _____ color.

C. Plywood: Softwood plywood with veneer core, waterproof glue, 3/4 inch (19 mm) thick.

D. Heat-Strengthened and Fully Tempered Glass: ASTM C1048, Kind FT.

PART 3 EXECUTION

3.1 PREPARATION

A. Rough openings, electrical pre-wiring, and final finishing are by other trades.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide factory trained installers.

C. Locate fastening devices to secure cases securely to back and sides of rough opening.

D. Install recessed display cases plumb and level in wall openings, ____ inches (____ mm) from finished floor to inside bottom of display case.

E. Refer to drawings for display case mounting heights.

F. Provide vinyl wrapped H-moldings to match vinyl covered boards.

G. Clean case and glass using manufacturers recommended procedures.

H. Provide mitered and wrapped hairline joints for all trims.

3.3 ADJUSTING AND CLEANING

A. Verify that all accessories are installed as detailed for each unit.

B. At completion of work, clean glass surfaces, back panels and trim in accordance with manufacturer's recommendations leaving units ready for use.

3.4 CLOSEOUT ACTIVITIES

A. Refer to Section 01 77 00 - Closeout Procedures, for closeout submittals.

END OF SECTION 10 12 00

SECTION 10 14 00 - GRAPHICS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Room identification signs.
   2. Exterior dimensional letter signage.
   3. Dedication plaque.
   4. Traffic Signage.
   5. Accessories necessary for a complete installation.

B. Allowance: Signage is affected by allowances. Refer to Section 01 21 00.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of signage.

B. Signage Shop Drawings: Submit fabrication and installation details and attachments to other Work.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Dedication Plaque Shop Drawings: Submit fabrication and installation details and attachments to other Work.
   1. Indicating materials, sizes, and finishes, details of fabrication and installation, fasteners and hardware, attachments, related and adjacent Work.
   2. Rubbing of actual pattern of cast metal plaque for Architect’s approval prior to casting.

D. Certifications: Submit letter of certification from manufacturer that installer and manufacturer is in compliance and meets specified requirements.

E. Samples:
   1. One (1) 6 inch x 6 inch sample of cast metal plaque material with specified finish.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code/City Code: Comply with building code and local ordinances for exterior signage.
   2. Accessibility Requirements: Comply with applicable requirements.
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS) 2012.

B. Installer Qualifications: Installer has minimum 5 Years documented experience in the manufacture of signage and who employs installers and supervisors trained and approved in installation methods for each type of signage.

C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.

   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design Manufacturer: South Texas Graphics; (713) 467-4499. Other manufacturers shall have a minimum of five (5) years experience manufacturing products meeting or exceeding those specified and shall comply with Division 1 requirements for substitutions in order to be considered.
   1. A.R.K. Ramos Architectural Signage Systems; (405) 235-5505.
   2. InPro Corporation (IPC); (800) 222-5566.
   3. ProWorx Architectural Signage; (713) 666-3131.
   4. Riot Creative Imaging; (713) 988-9200.
   5. Stanley Signature Signs; (281) 395-6106.
   6. The Southwell Co.; (210) 223-1831.

B. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

C. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

E. Acrylic Sheet: ASTM D 4802, category standard with manufacturer for each sign, Type UVF (UV filtering).

F. Plastic Laminate Sheet: NEMA LD 3, general purpose HGS grade, 0.048-inch (1.2-mm) nominal thickness.

G. Vinyl Film: UV resistant vinyl film of nominal thickness indicated, with pressure sensitive, permanent adhesive on back; die cut to form characters or images indicated and suitable for exterior applications.

H. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

I. Accessories:
1. Fasteners and Anchors: As necessary for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
   a. Use concealed fasteners and anchors unless indicated to be exposed.
   b. Exposed Metal Fastener Components: Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

2. Sign Mounting Fasteners:
   a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

3. Adhesive: Recommended by sign manufacturer.
4. Two Face Tape: High bond, foam core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
5. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187.

2.2 SIGNAGE

A. Room Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Laminated Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
   a. Color(s): Selected by Architect.

2. Sign Panel Perimeter: Finish edges smooth.
   a. Edge Condition: Beveled.
   b. Corner Condition in Elevation: Square.

3. Frame: Aluminum.
   a. Profile: Square.
   b. Corner Condition in Elevation: Square.
   c. Finish and Color: Painted, matte black color.

4. Mounting: Surface mounted to wall with concealed anchors.
5. Text and Typeface, Panel and Photo Polymer Signs: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.
   a. Raised Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above background, uppercase, san serif, minimum 5/8 inch to maximum 2 inch high (no decorative, italic, bold, oblique, script) with contrasting colors on symbols and text only.
   b. Braille: Domed or rounded shape; below corresponding text.
   c. Pictograms: Field height of minimum 6 inches; no characters or braille in pictogram field; nonglare, field contrast to pictogram, text descriptors below pictogram field
   d. Accessibility Symbols: Where used, symbols shall comply with International Accessibility Symbols.

B. Exterior Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles:
   1. Character Material: Cast aluminum.
   2. Character Height: Indicated on Drawings.
   3. Finishes:
      a. Baked Enamel or Powder Coat Finish: Color to match school colors and logo.
      b. Overcoat: Baked on clear coating.
   4. Mounting: Concealed studs.
   5. Typeface: Selected by Architect.

C. Traffic Signs:
   1. Signage Materials: 0.080 inch thick aluminum or galvanized steel sign with 1-1/2 inch silk screen upper case letters, copy and border. Signs shall have 1-1/2 inch radius at corners typically. Sizes shall be as shown on drawings or required by authorities having jurisdiction.
   2. Post Materials: Traffic Sign Posts: 2-3/8 inch diameter galvanized steel.
   3. Graphics:
      a. "Traffic" signs with lettering and graphics as detailed. All work shall comply with local codes, and standards ands requirements of authorities having jurisdiction. Include in Allowance.
   4. Post Anchor Bolts: Two (2) galvanized 1/2 inch by 6 inch Nelson anchor bolts welded to steel tube front and back.
   5. Accessories:
      a. Sign Mounting Hardware: Provide sign mounting hardware of galvanized steel of type and size recommended by manufacturer to suit intended use.
      b. Provide concrete footings of 3,000 psi compressive strength at 28 days, unless noted or directed otherwise.
      c. Provide all materials required for signage and proper installation.

2.3 DEDICATION PLAQUE

A. Cast Metal Dedication Plaque:
   1. Material and Fabrication:
      a. Casting: Prime bronze ingots of Alloy 220 Commercial bronze free of pits and gas holes and all letters shall be sharp and hand tooled.
      b. Border Style: Single line standard border design.
      c. Letter Style/Sizes: Shall be Helvetica Medium in both upper and lower case letters, unless shown otherwise. Letter sizes shall be as shown on drawings.
      d. Finishes:
         1) Borders and Letter Faces: satin finish.
         2) Plaque Background: Pebble texture finish with baked on acrylic coating.
         3) Plaque shall be chemically cleaned.
         4) Completed plaque shall be sprayed with two (2) coats of clear hardened acrylic polyurethane.
      e. Size: As shown on drawings.
   2. Fasteners and Attachment Hardware: Concealed fasteners and hardware of size and type recommended by manufacturer for attachment of plaque on brick wall where indicated on drawings.
   3. Provide all materials required for a complete installation.
   4. Approved Manufacturers:

a. A.R.K. Ramos Architectural Signage Systems, Oklahoma City, OK; (405) 235-5505
b. Best Manufacturing Sign Systems, Montrose, CO; (800) 235-2378
c. York Bronze Company, Bryan, TX; (800) 488-4662
d. Gemini Incorporated, Cannon Falls, MN; (800) 538-8377
e. Matthews Bronze, Pittsburgh, PA; (800) 950-1317
f. Metal Arts, Division of L & H Mfg. Co., Mandan, ND; (800) 237-8069
g. ProWorx Architectural Signage, Houston, Texas; (713) 666-3131
h. The Southwell Co., San Antonio, TX; (210) 223-1831 (Basis of Specification).

2.4 FABRICATION

A. Provide sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing Work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket mounted signs to suit sign construction and mounting conditions indicated. Modify brackets as necessary.
1. Aluminum Brackets: Factory finish brackets with baked enamel or powder coat finish to match sign background color color unless otherwise indicated.

2.5 FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

E. Aluminum Finishes:
   1. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
   2. Baked Enamel or Powder Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of signage Work. Verify sign support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to the accessibility standard.
   3. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
      a. Comply with all applicable accessibility requirements for mounting height and location of each sign.

   4. Before installation, verify sign surfaces are clean and free of materials or debris that impair installation.
   5. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

   2. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
   3. Shim Plate Mounting: Provide 1/8 inch (3 mm) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using method specified above.

C. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

D. Cast Metal Dedication Plaque:
   1. Install in accordance with manufacturer’s instructions.
   2. Install in location shown on drawings.
   3. Install with concealed fasteners of threaded bolt screwed into back of plaque and inserted into hole drilled in brick at an angle and filled with cement.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 14 63 - ELECTRONIC MESSAGE SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions and details.

B. Shop Drawings: Manufacturer's complete shop drawings for Architect's approval.

C. Samples: Actual material or color charts showing manufacture's full range of colors and styles for Architect's selection and approval. Anodized aluminum shall be selected from full range of colors, including clear.

1.3 WARRANTY

A. Warrant work of this section for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Atlas Sign Services, Inc.
   2. Daktronics, Inc.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 ELECTRONIC MARQUEE SIGN

A. Basis of Design: "Galaxy GS6" manufactured by Daktronics, Inc.

B. Features: Include shading, additional text effects and increased memory capacity.

C. Technical Characteristics:
   1. Line-and-Column Spacing: 15.85 mm.
   2. Character Height: 4.4 inches (7 pixel font).
   3. Pixel Configuration: 1 red, 1 green 1 blue.
   4. Maximum Brightness: 12,000 nits.
   5. Lifetime (0.5 brightness): 100,000+ hours.
   6. Color Capability: 281 trillion colors.
   7. Horizontal Viewing Cangle: 140 degrees.
   8. Vertical Viewing Angle: 70 degrees.
   9. Horizontal Readability Angle: 160 degrees.
   10. Vertical Readability Angle: 90 degrees.
   11. Minimum Viewing Distance: 37 feet.
   12. Contrast Enhancement: Non-reflective black louvers and module face grooves disperse light.
   13. Graphic Capability: Text, graphics, logos, basic animation, video clips, multiple font styles, and sizes.
   14. Control Software: Venus Control Suite.

15. Power: 120/240 VAC single phase.
16. Display Dimming: 64 levels (automatic, scheduled, or manual control).
17. Operating Temperature: -40 to 120 degrees F with 99% RH non-condensing.
18. Compliance Information: UL and cUL Listed, UL-Energy Verified, FCC compliance
19. Quantity: As indicated on Drawings
20. Location(s): As indicated on Drawings

2.3 POLE, PIER AND TOP ID CABINET AND POLE COVER ASSEMBLY

A. Basis of Design: Model #3 x 8 manufactured by Atlas Sign Services, Inc.

B. Technical Characteristics:
1. Steel Pole and pier foundation
2. Complete with brackets, mounts and end panels
3. 1 1/2” steel tube frame
4. 0 inch thick Pre-Finished Aluminum Filler
5. 3/16” Clear Polycarbonate Faces with basic message
6. 2 mil cast translucent vinyl film decoration
7. 800 Ma Fluorescent lamps
8. Bottom pole cover 4’ x 8’

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas where electronic marquee signs are to be installed to ensure proper opening sizes and that areas are ready to receive installation.

B. Coordinate work with work specified in Divisions 26 and 27 to ensure proper electrical power and data is provided for all electronic marquee signs.

3.2 INSTALLATION

A. Install electronic marquee signs and accessories in accordance with printed manufacturer’s instructions.

B. Electronic marquee sign installer shall provide licenses or permits required for the installation of this sign including approval of all authorities having jurisdiction.

C. Provide all accessories necessary for a complete installation.

D. Provide Owner training and software installation assistance.

END OF SECTION 10 14 63

SECTION 10 21 13.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Solid surface toilet compartments.

C. Urinal and vestibule screens.

1.2 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Concealed steel support members.

B. Section 05 50 00 - Metal Fabrications: Concealed steel support members.

C. Section 06 10 00 - Rough Carpentry: Blocking and supports.

D. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

E. Section 10 28 19 - Tub and Shower Enclosures: Shower compartment construction.

1.3 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 by 6 inches (150 by 150 mm) in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. Solid Plastic Toilet Compartments:
    a. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
    b. AJW Architectural Products: www.ajw.com/#sle.
    c. ASI Accurate Partitions: www.asi-accuratepartitions.com/#sle.
    d. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
    e. Inpro: www.inprocorp.com/#sle.
    f. Metpar Corp: www.metpar.com/#sle.
    g. Partition Systems International of South Carolina: www.psisc.com/#sle.
    h. Scranton Products: www.scrantonproducts.com/#sle.

i. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2. Solid Surface Toilet Compartments:
   a. DuPont Corian: www.privacypluspartitions.com/#sle.
   b. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures .

2.2 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted, headrail-braced.
   1. Basis of Design: Hiny Hiders as manufactured by Scranton or Architect approved equal.
   2. Color: To be selected by Architect full available range of colors. .
   3. Doors:
      a. Thickness: 1 inch (25 mm).
      b. Width: 24 inch (610 mm).
      c. Width for Wheelchair Accessible Compartments: 36 inch (915 mm), out-swinging.
      d. Height: As indicated on Drawings.
   4. Panels:
      a. Thickness: 1 inch (25 mm).
      b. Height: As indicated on Drawings.
      c. Width: As indicated on Drawings.
   5. Pilasters:
      a. Thickness: 1 inch (25 mm).
      b. Width: As indicated on Drawings.
   6. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.3 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
   2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Head Rails: Extruded aluminum, anti-grip profile.
   1. Size: Manufacturer's standard size.

C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hinges: Stainless steel, manufacturer's standard finish.
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Continuous-type hinge, self closing.

F. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings.
   3. Door Latch: Slide type with exterior emergency access feature.
   4. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   5. Provide door pull for outswinging doors.
   6. Coat Hook: Refer to Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

G. Toilet Partition Suspension Members: Refer to Section 05 50 00 - Metal Fabrications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets.

E. Locate head rail joints at pilaster center lines.

F. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.4 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10 21 13.19

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SECTION 10 21 23 - CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended, overhead curtain track and guides.

B. Surface-mounted, overhead curtain track and guides.

C. Cubicle curtains.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Above ceiling track supports.

B. Section 06 10 00 - Rough Carpentry: Above ceiling blocking and track supports for track.

C. Section 09 51 00 - Acoustical Ceilings: Suspended ceiling system to support track.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics and _____.

C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.

D. Samples: Submit 12 by 12 inch (300 by 300 mm) sample patch of curtain cloth with representative top, bottom, and edge hem stitch detail, heading with reinforcement and carrier attachment to curtain header.

E. Samples: Submit 12 inch (300 mm) sample length of curtain track including typical splice, wall and ceiling hanger, and escutcheon.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

G. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Curtains: Two of each type and size.
   3. Extra Carriers: Ten.

1.5 MOCK-UP

A. Provide _____ mock-up, ____ feet (____ m) long by ____ feet (____ m) wide, with curtain track, curtain, cords and accessories.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. A. R. Nelson Co: www.arnelson.com/#sle.
   2. Construction Specialties, Inc; Track Systems: www.c-sgroup.com/#sle.
   3. Imperial Fastener Co., Inc: www.imperialfastener.com/#sle.
   4. Inpro: www.inprocorp.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 TRACKS AND TRACK COMPONENTS

A. Tracks: Extruded aluminum sections; one piece per track run.
   1. Profile: Channel.
   2. Mounting: Surface.
   3. Structural Performance: Capable of supporting vertical test load of 50 lbs (23 kg) without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
   4. Track End Stop: To fit track section.
   5. Track Bends: Minimum 12 inch (300 mm) radius; fabricated without deformation of track section or impeding movement of carriers.
   6. Suspension Rods: Tubular aluminum sections, sized to support design loads and designed to receive attachment from track and ceiling support.
   7. Escutcheons: Where suspension rod meets finished ceiling or structure, provide escutcheons to match rod finish.
   8. Finish on Exposed Surfaces: Clear anodized.
   9. Products:
      a. American Track Supply; Aluminum Track: www.americantracksupply.com/#sle.
      b. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.
   1. Provide __ carriers per foot of track length (__ carriers per meter of track length)

C. Wand: Aluminum, attached to lead carrier, for pull-to-close action.

D. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.3 CURTAINS

A. Cubicle Curtains:
   1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
   3. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
   4. Color/Pattern: To be selected by Architect from Manufacturer's full range..
   5. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, manufacturer's standard color to be selected by Architect from full available range of colors.
   6. Fabrication: Railroad.
   7. Attachment of Curtain Fabric to Open Mesh Cloth: Manufacturer's standard sewn seam.
   8. Products:
      a. CLOCKEZE as manufactured by INPRO or Architect Approved equal..
      b. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Curtain Fabrication:
   1. Width of curtain to be 10 percent wider than track length.
   2. Length of curtain to end 15 inches (380 mm) above finished floor.
   3. Railroad fabric without vertical seams.
   4.
   5. Include open mesh cloth at top 20 inches (508 mm) of curtain for room air circulation, attached to curtain as specified above.
   6. Curtain Heading: Fabric band matching curtain panel with metal grommet holes for carriers spaced 6 inches (150 mm) on center.
   7. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

B. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Install curtain track to be secure, rigid, and true.

B. Refer to Section 05 50 00 - Metal Fabrications for track supports above ceiling.

C. Refer to Section 06 10 00 - Rough Carpentry for blocking and track supports above ceiling.

D. Secure track to ceiling system.

E. Install end cap and stop device.

F. Install curtains on carriers ensuring smooth operation.

END OF SECTION 10 21 23

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SECTION 10 22 13 - WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wire mesh systems for walls, ceilings, and stairways.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Cylinders for locksets.

B. Section 09 90 00 - Painting and Coating.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

D. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2020.

E. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2018.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for mesh materials, finishes, and _____.

C. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, anchorage, and type and location of fasteners.
   1. Show field measurements on shop drawings.

D. Samples: Submit two, ____by____ inch (____by____ mm) in size, illustrating mesh material. Submit samples of hinge and latchset illustrating style, color, and finish. Incorporate sample into the work.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and _____.

F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   1. Member firm of the Woven Wire Products Association (WWPA).

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Acorn Wire and Iron Works, Inc: www.acornwire.com/#sle.
   2. California Wire Products Corp.
   3. The G-S Company; Sure Guard Standard Duty: www.g-sco.com/#sle.
   4. Indiana Wire Product.
   5. Kentucky Metal Products Co
   6. Standard Wire & Steel Works.
   7. Superior Wire and Metal Products, Inc.
   8. Central Wire and Iron Works.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 WIRE MESH PARTITIONS

A. Wire Mesh Partitions: Factory-fabricated modular assemblies of panels, doors, anchors, hardware, and accessories as required to provide a complete system.
   1. Design Criteria:
      a. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
      b. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
      c. Comply with applicable code for wire mesh opening size.
      d. Height: Wire Mesh Partition height shall match the height of the ceiling in rooms with with ceilings and shall be extended to metal roof deck in rooms that do not have ceilings.

2.3 COMPONENTS

A. Woven Wire Mesh: Heavy duty.
   1. Weave: Plain.
   2. Finish: Powder Coat.
   3. Color: Black.

B. Framing and Support Members:
   1. Material: ASTM A36/A36M steel shapes.
   2. Framing, Corner Posts, and Intermediate Support Members: Manufacturer's standard sizes for system specified and as indicated on drawings.
   3. Vertical Stiffeners: As required for partitions greater than 144 inches (3658 mm) in height.

C. Doors: Same material as partitions, fully framed; manufacturer's standard construction and hardware for swing operation.
   1. Locking: Integrated padlock hasps for padlocks provided by Owner.
   2. Locking: Mortise type cylinder locks, keyed on outside, operated by door knob inside.
   3. Locking: Mortise type cylinder locks as specified in Section 08 71 00 - Door Hardware.

D. Service Window: Same material as partitions; manufacturer's standard construction for lift-up operation.

E. Sheet Metal Base Panel: ASTM A1008/A1008M, cold rolled steel sheet.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.4 FASTENERS

A. Bolts, Nuts and Washers: Hot dip galvanized.

B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of structure.

2.5 ACCESSORIES

A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

C. Post Caps: Manufacturer's standard.

D. Floor and Ceiling Pilaster Shoe: Manufacturer's standard.

E. Floor Base: Manufacturer's standard.

2.6 FABRICATION

A. Fit and assemble in largest practical sections for delivery to site, ready for installation.

B. Make exposed joints flush or tight.

C. Provide mortised and tenoned joints for framing members.

D. Provide components required for anchorage to adjacent construction.

E. Frame openings made for penetrating mechanical and electrical components.

2.7 FINISHES

A. Factory Finish: Manufacturer's standard powder coat finish.
   1. Color: Black..

B. Field Painted Finish: As specified in Section 09 90 00 - Painting and Coating.

C. Galvanized Finish: In accordance with requirements of ASTM A123/A123M.

D. Leave components unfinished.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that substrate surfaces and required openings are ready to receive work.

3.2 PREPARATION

A. Clean substrate surfaces.

B. Clean partition surfaces of rust, scale, grease, and foreign matter prior to field finishing as specified in Section 09 90 00 - Painting and Coating.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. After installation, touch-up field welds scratched or damaged surfaces with shop applied finish.

3.4 TOLERANCES

A. Maximum Variation From Plumb or Level: 1/4 inch (6 mm).

B. Maximum Misalignment From True Position: 1/4 inch (6 mm).

3.5 ADJUSTING

A. Adjust doors to achieve free movement.

3.6 CLEANING

A. Remove temporary protection to prefinished surfaces.

END OF SECTION 10 22 13

SECTION 10 22 39 - FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Top-supported folding panel partitions, horizontal opening.
   2. Top-supported operable panel partitions, vertical opening, electrical operation.

B. Related Requirements:
   1. Section 06 10 00 - Rough Carpentry: Wood blocking and track support shimming.
   2. Section 08 71 00 - Door Hardware: Lock cylinders for panels
   3. Section 09 90 00 - Painting and Coating: Field applied paint finish to panels.
   4. Section 10 11 00 - Visual Display Units: Product requirements for markerboard finish for installation by this section.

1.2 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

I. ASTM E413 - Classification for Rating Sound Insulation; 2022.

J. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).

K. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures; 1996 (Reapproved 2016).

L. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
   1. Require attendance by representatives of installer.
   2. Notify Architect four calendar days in advance of scheduled meeting date.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, track switching components, and colors and finishes available.

C. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.

D. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.

E. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.

F. Samples for Review: Submit two samples of surface finish, 12 by 12 inches (300 by 300 mm) size, illustrating quality, colors selected, texture, and weight.

G. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

H. Manufacturer's Instructions: Indicate special procedures.

I. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

1.7 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within five year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Folding Panel Partitions - Horizontal Opening:
      a. Kwik-Wall Company: www.kwik-wall.com/#sle.
      b. Moderco, Inc: www.moderco.com/#sle.
      c. Modernfold, a DORMA Group Company: www.modernfold.com/#sle.
   2. Operable Panel Partitions - Vertical Opening:

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 LARGE FOLDING PANEL PARTITIONS

A. Basis of Design: Signature 800 Model 842 as manufactured by Moderco, STC 52.

B. Folding Panel Partitions: Side opening; paired panels; side stacking; manually operated.

C. Panel Construction:
   1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
   2. Substrate: Gypsum board.
      a. High impact rated.
   3. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
   4. Hinges: Continuous piano type, ___ gauge, _____ inch (_____ mm)stainless steel.
   5. Panel Properties:

a. Thickness With Finish: 4 inches (100 mm).
b. Width: Standard width.
c. Weight: 8 lb/sq ft (40 kg/sq m).

D. Panel Finishes:
1. Facing: Face finish shall be steel and writable surfaces as indicated on Drawings.
2. Trim: Refer to Drawings..

E. Panel Seals:
1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
2. Acoustic Seals: Flexible acoustic seals at jambs, meeting mullions, ceilings, retractable floor and ceiling seals, and above track to structure acoustic seal.

F. Suspension System:
1. Track: Formed steel; 1-1/4 by 1-1/4 inch (32 by 32 mm) size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
2. Carriers: Nylon wheels on trolley carrier at top of every second panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.

G. Performance:
1. Acoustic Performance:
a. Noise Reduction Coefficient (NRC): ASTM E596, NRC of 0.65 minimum.
b. Sound Transmission Class (STC): 38 to 42 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).
2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

H. Operation:
1. Manual.
2. Control Station: One standard keyed, three button OPEN-STOP-CLOSE type; 24 volt circuit; surface mounted.
a. Key switch prepared for mortise lock cylinder.
b. Key switches alike.
3. Safety Features:
a. Each folding panel partition must have a man door in at least one panel.
b. Limit Switches: Automatic type, at both extremes of travel, to prevent over-travel.
c. Emergency Release: Mechanism to disengage motor drive system and permit manual operation.
d. Pocket Door Interlock: Mechanism to prevent operation of panels unless storage pocket doors are fully open.

I. Accessories:
1. Ceiling Closure: White enameled ceiling closure; aluminum jamb and head molding, fittings and attachments, and intermediate meeting posts.
2. Pocket Enclosures: Door, frame, and trim to match adjacent walls.
3. Pass Door: Single door-same design and construction as panel; fit door with perimeter acoustic gaskets, concealed closer, keyed lock, and tool operated floor seal.
4. Acoustic Sealant: As recommended by partition manufacturer

2.3 OPERABLE PARTITION: GLASS FOLDING PANEL PARTITIONS

A. Basis of Design: Crystal 200 Model 241 as manufactured by Moderco.

B. Operable Panel Partition: Side opening; individual panels, side stacking; manual operated.

C. Panel Construction:

1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
2. Substrate: Gypsum board.
3. Panel Substrate Facing: Steel sheet, ___ gauge, ___ inch (____ mm) thick.
4. Panel Properties:
   a. 1/4 inch (6mm) tempered glass.
   b. Height - Intermediate Panel: Up to 30 inches (762 mm) height.
   c. Height - Lead Panel: Up to 27 inches (686 mm) in height to fit opening.
   d. Weight: 9.5 lb/sq ft (46.5 kg/sq m), not including lifting equipment.

D. Panel Finishes:
   1. Facing: Face finish shall be glass as indicated on Drawings.

E. Glass type: Tempered.

F. Panel Seals:
   1. Panel to Panel Seals: Tongue and groove configuration, color to match panel finish.
   2. Horizontal Bottom Seal: Retractable safety sensor seal providing minimum of 2 inches (51 mm) floor adjustability to accommodate out-of-level floors.

G. Accessories:
   1. Pass Door: Single door.

H. Suspension System:
   1. Guide Rails: Extruded aluminum; 6 inches (152 mm) wide and 6 inches (152 mm) deep.
      a. Adjustable up to 1/4 inch (6 mm) to compensate for out-of-plumb walls.
      b. Provide constant power to safety limit switches.
   2. Guide Rollers: Sealed rollers with hardened steel ball bearings.
      a. Two adjustable rollers per panel.
      b. Minimum 1 inch (25 mm) diameter carrier bolt per roller.
   3. Drive Box: Hardened steel construction.
      a. Supports weight of panels in stacked position.

I. Performance:
   1. Acoustic Performance:
      a. Noise Reduction Coefficient (NRC): ASTM E596, NRC of 0.65 minimum.
      b. Sound Transmission Class (STC): Minimum of 44 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).
   2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

J. Operation:
   1. Control Station: One standard keyed switch (RESET-OFF-ON) and one two-position (OPEN-CLOSE, constant pressure) type rocker switch; 24 volt circuit; surface mounted.
      a. Master key switch prepared for mortise lock cylinder.
      b. Key switches alike.
   2. Safety Features:
      a. Each folding panel partition must have a man door in at least one panel.
      b. Limit Switches: Automatic type, at both extremes of travel, to prevent over-travel.
      c. Emergency Release: Mechanism to disengage motor drive system and permit manual operation.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Standard Gypsum Board: ASTM C1396/C1396M, 3/8 inch (9.5 mm) thick, maximum permissible length; ends square cut, square edges.

C. Fire Rated Gypsum Board: ASTM C1396/C1396M, Type X, UL rated; 1/2 inch (12.7 mm) thick, maximum practical length; ends square cut, square edges.

D. Acoustic Insulation:
   1. Type: As required for acoustic performance indicated.
   2. Thickness: As required for acoustic performance indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

C. Verify track supports are laterally braced and will permit track to be level within 1/4 inch (6.4 mm) of required position and parallel to the floor surface.

D. Verify floor flatness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

E. Verify wall plumbness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

3.2 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Install electric operator, wiring, and controls. Locate control station(s) as indicated.

C. Fit and align partition assembly and pocket doors level and plumb.

D. Lubricate moving components.

E. Install acoustic sealant to achieve required acoustic performance.

F. Coordinate electrical connections.

3.3 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.4 CLEANING

A. Clean finish surfaces and partition accessories.

B. Condition markerboard surfaces in accordance with manufacturer's instructions.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION 10 22 39

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SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Corner guards.
   2. Protective wall covering.

B. Related Requirements:
   1. Section 05 50 00 - Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.
   2. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.
   3. Section 08 71 00 - Door Hardware: Standard protection plates and trim.
   4. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.3 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015 (Reapproved 2021)e1.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two samples of protective wall covering and door surface protection, 6 by 6 inches (152 by 152 mm) square.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attentio

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
   1. Refer to Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards.

H. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.6 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.
   1. Failures include, but are not limited to, the following:
      a. Structural failures or internal connection failures.
      b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

C. Installer Warranty: Provide 5-year warranty for metal crash rails commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.
   1. Failures include, but are not limited to, the following:
      a. Detachment of rail system from substrate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Corner Guards:
      a. Babcock-Davis: www.babcockdavis.com/#sle.
      b. Construction Specialties, Inc: www.c-sgroup.com/#sle.
      c. Inpro: www.inprocorp.com/#sle.
      d. Koroseal Interior Products: www.koroseal.com/#sle.
   2. Protective Wall Covering:
      a. Construction Specialties, Inc: www.c-sgroup.com/#sle.
      b. Inpro: www.inprocorp.com/#sle.
      c. MDC Interior Solutions: www.mdcwall.com/#sle.
      d. Pawling Corp: www.pawling.com/#sle.
      e. Momentum Textiles and Wallcoverings: www.momentumtextilesandwalls.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.3 PRODUCT TYPES

A. Corner Guards - Surface Mounted, PETG:
1. Basis of Design: Acrovyn SSM-20AN manufactured by Construction Specialties, Inc.
2. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
3. Performance: Resist lateral impact force of 100 lbs (445 N) at any point without damage or permanent set.
4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
5. Width of Wings: 2 inches.
6. Corner: 1/4 inch radius.
7. Color: As selected by Architect from manufacturer's standard finishes.
8. Projection From Wall to Outside of Guard: 3/8 inch (3/8 inch (9.5 mm).
9. Length: One piece, .80 inches (2032 mm)
10. Preformed end caps.

B. Plastic Sheet Wall Covering:
1. Basis of Design: Acrovyn manufactured by Construction Specialties.
2. Material: High-impact acrylic-modified vinyl.
3. Thickness: 0.040 inch (1.02 mm).
4. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
5. Color: As selected by Architect from manufacturer's standard finishes.
6. Texture: Suede.
   a. Texture Direction: As determined by Architect..
7. Accessories: Provide manufacturer's standard color-matched trim and moldings.
8. Mounting: Adhesive.

2.4 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

2.5 SOURCE QUALITY CONTROL

A. Refer to Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.
1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position protective wall covering no less than 1 inch (25.4 mm) above finished floor to allow for floor level variation.
   1. Full-Height Installation: Establish a plumb line located at edge of starting point of first sheet to ensure following sheets will be installed plumb.
   2. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
   3. Apply adhesive with 1/8 inch (3.2 mm) V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
   4. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
   5. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.4 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION 10 26 00

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Washroom accessories.
   2. Toilet accessories.
   3. Shower room accessories.
   4. Warm air dryers.
   5. Childcare accessories.
   6. Custodial accessories.
   7. Accessories necessary for a complete installation.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. Texas Accessibility Standards (TAS) - 2012 Texas Accessibility Standards (TAS); 2012.

1.3 SUBMITTALS

A. Product Data: Technical Data including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   2. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.
   1. Approved full size Samples will be returned and may be used in the Work.

C. Product Schedule: Show types, quantities, sizes, and installation locations by room of each accessory required. Identify locations using room designations indicated.

D. Maintenance Data: Submit for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements: Comply with applicable requirements.
      a. U. S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS).

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Source Limitations: Obtain products from single source from single manufacturer.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Mirrors: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. AJW Architectural Products.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. Brey-Krause Manufacturing Co.
   6. GAMCO Specialty Accessories; a division of Bobrick.
   7. Georgia Pacific.
   8. Tubular Specialties Manufacturing, Inc.

B. Stainless Steel: ASTM A666/A666M, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated

C. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings

D. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness

E. Galvanized Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot dip zinc coating

F. Galvanized Steel Mounting Devices: ASTM A153/A153M, hot dip galvanized after fabrication

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear glass mirrors, nominal 6.0 mm thick

2.2 COMPONENTS

A. Underlavatory Guard: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   1. Material and Finish: Antimicrobial, molded plastic, white

2.3 FABRICATION

A. Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items. Remove temporary labels and protective coatings. Clean and polish exposed surfaces according to manufacturer's written recommendations.

PART 4 SCHEDULE

4.1 ACCESSORY SCHEDULE

A. TA-1W - Soap Dispensers – Wall-Mounted: OFOI

B. TA-2 - Lavatory Mirrors, Typical:
   1. Mounting: Surface.
   2. Basis of Design: Bobrick B-290 2436.
   3. Size: Refer to Drawings.
   4. Location: At each lavatory.

C. TA-2F - Full-Length Mirrors:
   1. Mounting: Surface.
   2. Basis of Design: Bobrick B-290 2472.
   3. Size: 24 inches by 72 inches.
   4. Location: Where indicated on Drawings.

D. TA-3 - Toilet Paper Dispensers: OFOI

E. TA-4 - Paper Towel Dispensers: OFOI

F. TA-5 - Grab Bars: (At Wheelchair-Accessible Water Closets)
   1. Size/Finish: 1-1/2 inch diameter satin stainless steel.
   2. Clearance: 1-1/2 inch between rail and wall.
   3. Basis of Design: Bobrick B-6806 x 42, B-6806 x 36.
   4. Mounting: Attach with concealed mounting kit. Mount parallel to floor.
   5. Location: At each wheelchair-accessible water closet.

G. TA-6 - Sanitary Napkin Dispensers: OFOI

H. TA-7 - Sanitary Napkin Disposal: OFOI

I. TA-8 - Shelf with Mop and Broom Holders and Hooks:
   1. Mounting: Surface.
   2. Model No.: B-239 x 34.
   3. Capacity: Four hooks, three mop holders.
   4. Locations: Mop sink at each custodial rooms.

J. TA-9 - Grab Bars: (At Accessible Shower)
   1. Mounting: Surface.
   2. Basis of Design: Bobrick B-6861 modified (24 x 16).
   3. Locations: At each accessible shower stall.

K. TA-10A - Folding Benches: Adult Height:
   1. Mounting: Surface, reversible.
   2. Basis of Design: Bobrick B-5181.
   3. Locations: Where indicated on Drawings.

L. TA-11 - Clothing Hook:
   1. Mounting: Surface.
   2. Basis of Design: Bobrick B-6717.
   3. Locations: All shower locations.
   4. Toilet and Shower Partitions: If toilet and shower partitions are utilized, hooks are to be provided by the partition manufacturer(s) as part of their hardware package.

M. TA-12 - Shower Curtains, Rods and Hooks:
   1. Basis of Design:
      a. Rods: Bobrick B-6107 (36 inches or as indicated).
      b. Curtains: Bobrick B-204-2 (42 inches x 72 inches or as required).
      c. Hooks: Bobrick B-204-1.
   2. Mounting/Locations: Where indicated on Drawings.

N. TA-13 - Electric Hand Dryers:
   1. Mounting: Semi-Recessed, maximum 3-9/16 inch recess.
   2. Basis of Design: Bobrick B-750, white.
   3. Voltage: 120 volt, single phase.
   4. Location: Where indicated on Drawings.

O. TA-15 - Grab Bars: (At Ambulatory-Accessible Toilet Compartments):
   1. Size/Finish: 1-1/2 inch diameter satin stainless steel, lengths as indicated in drawings.
   2. Clearance: 1-1/2 inch between rail and wall.
   3. Basis of Design: Bobrick B-6806 x 36.
   4. Mounting: Attach with concealed mounting. Mount parallel to floor.
   5. Location: At each ambulatory-accessible toilet compartment.

P. TA-18 - Vertical Grab Bar:
   1. Mounting: Surface.
   2. Basis of Design: Bobrick B-6806x18.
   3. Locations: As indicated on Drawings.

Q. TA-21: Hand Sanitizer Dispenser:
   1. Mounting: Surface.
   2. Basis of Design: 6A02-11 as manufactured by Bradley.
   3. Capacity: 27 Oz.

END OF SECTION 10 28 00

SECTION 10 43 00 - EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Automated external defibrillators (AEDs).

B. Automated external defibrillator (AED) cabinets.

C. Key boxes.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 90 00 - Painting and Coating: Field paint finish.

1.3 DEFINITIONS

A. Automated External Defibrillator (AED): A Food and Drug Administration (FDA)-approved portable device, which automatically analyzes the heart rhythm and recognizes the presence of ventricular fibrillation and/or tachycardia. If defibrillation is warranted, the AED automatically charges and prompts (visual and/or audio) the operator to deliver an electrical shock.

1.4 REFERENCE STANDARDS

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Provide AED operational features, color and finish, anchorage details, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test schedules and recertification requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. Automated External Defibrillators (AEDs):
   a. Philips Medical Systems: www.usa.philips.com/#sle.
   b. Stryker Corporation; HeartSine samaritan PAD 350P Defibrillator - PAD 350p: www.stryker.com/#sle.
   c. ZOLL Medical Corporation: www.zoll.com/#sle.
   d. J.L. Industries, Inc.
2. Emergency Aid Cabinets and Accessories:
   a. Activar Construction Products Group, Inc. - JL Industries; LifeStart 1400 Series AED Cabinet: www.activarcpg.com/#sle.
   b. Modern Metal Products, a division of Technico, Inc: www.modern-metal.com/#sle.
3. Key Boxes:
   a. Knox Company: www.knoxbox.com/#sle.

2.2 AUTOMATED EXTERNAL DEFIBRILLATORS (AEDS)

A. Automated External Defibrillators (AEDs) - General: FDA approval required.

1. Provide automated external defibrillators (AEDs) as indicated.
2. Automated external defibrillators (AEDs) shall be provided by Owner.

2.3 EMERGENCY AID CABINETS

A. Type: Automated external defibrillator (AED).

B. Basis of Design: 1400 Series Steel Cabinet as manufactured by J.L., Inc. or Architect approved equal.

C. Cabinet Configuration: Recessed, Semi-recessed, or Surface-mounted type as indicated on Drawings..
   1. Size each cabinet to accommodate _____ or AED as indicated on Drawings.
   2. Trim:
      a. At Recessed Cabinets: Trimless type.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

D. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with wire pull handle and nylon catch. Hinge door for 180 degree opening with two butt hinges.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

H. Finish of Door Pull or Handle: Stainless steel.

I. Finish of Cabinet Interior: White powder coat.

2.4 KEY BOXES

A. Basis of Design: 3200 Series manufactured by Knox Company.

B. Mounting: Fully-recessed, as indicated on drawings. Surface mounted units are not acceptable.

C. Finish: Dark Bronze.

D. Provide (6) Key Boxes. Architect to provide installation locations.

2.5 ELEVATOR KEY BOXES

A. Basis of Design: Elevator Box Series as manufactured by Knox Company.

B. Mounting: Fully-recessed, as indicated on drawings. Surface mounted units are not acceptable.

C. Finish: Dark Bronze.

D. Provide (1) Elevator Box at each elevator Architect to provide installation locations

2.6 ACCESSORIES

A. Theft Alarm: Battery operated audible and strobe light alarm, 10 second delay for disarming, activated by opening cabinet door. Alarm deactivated when door is closed.

B. Alarm Contacts: Contact devices.
   1. Magnetic door contact for existing alarm systems.

C. Plastic Wall Signage: Flat style.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. AED Installation:
   1. Install in accordance with manufacturer's instructions.

B. Wall Signs:
   1. Location: Where indicated on Drawings.
   2. Apply on walls after field painting is completed and has been accepted.

C. Cabinet Lettering:
   1. Location: Face of door framing.

D. Key Box Installation:
   1. Install in accordance with manufacturer's instructions.
   2. Location: As indicated on Drawings or as directed by Authorities Having Jurisdiction (AHJ).

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors to operate smoothly without binding.

C. On completion of installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes. Replace products that cannot be restored to factory-finished appearance. Use materials and procedures recommended by cabinet manufacturer.

3.4 CLOSEOUT ACTIVITIES

A. Refer to Section 01 77 00 - Closeout Procedures for closeout submittals.

B. Refer to Section 01 79 00 - Demonstration and Training for additional requirements.

C. Demonstrate proper operation of AED to Owner's designated representative.

END OF SECTION 10 43 00

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SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire blankets.

C. Fire extinguisher cabinets.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 90 00 - Painting and Coating: Field paint finish.

1.3 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

B. FM (AG) - FM Approval Guide; Current Edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Provide _____.

C. Shop Drawings: Indicate _____.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.5 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. Fire Extinguishers:
    a. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
    b. Nystrom, Inc: www.nystrom.com/#sle.
    c. Potter-Roemer: www.potterroemer.com/#sle.
    d. The Williams Bors. Corportaiton of America.
    e. J.L. Industries., Inc.
2. Fire Extinguisher Cabinets and Accessories:
    a. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
    b. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
    c. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
    d. Nystrom, Inc: www.nystrom.com/#sle.

e. Oval Brand Fire Products: www.ovalfireproducts.com/#sle.
f. Potter-Roemer: www.potterroemer.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Basis of Design: Cosmic 10E as manufactured by Activar, or Architect approved equal.
2. Class: B:C type.
3. Size: 10 pound (4.54 kg).
4. Finish: Baked polyester powder coat, Red color.
5. Must provide eye brackets for direct wall mounted fire extinguisher installation.

2.3 FIRE EXTINGUISHER CABINETS

A. General:
1. Size to accomodate indicated extinguisher and accessories.
2. Doors:
a. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
3. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
4. Fabrication: Weld, fill, and grind components smooth.
5. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
6. Finish of Cabinet Interior: White enamel.
7. Finish of Doors: No.4 Brushed Stainless Steel door with clear acrylic vertical window panel.
8. Pull Handle: Satin finish pull handle with cam cylinder lock with safety pull deisgned to release upon firm pull on handle.

B. Standard Cabinet Construction:
1. Non-fire-resistance-rated.
2. Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.
3. Formed aluminum; ____ inch (____ mm) thick base metal.

C. Fire-Resistance-Rated Cabinet Construction:
1. Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
2. Steel; double wall or outer and inner boxes with 5/8 inch (15.9 mm) thick fire barrier material.

D. Cabinet Configuration: Partially-Recessed.
1. Trim: Flat rolled edge, with ____ inch (____ mm) wide face.
2. Basis of design: Model 1037W10 by Activar, or Architect approved equal.
3. Maximum of 3 inch protrusion from wall.

2.4 FIRE BLANKET CABINET

A. Drop-Type Fire Blanket Cabinet
1. Basis of Design: Royal Series Model 9613S21 as manufactured by J.L. Industries.
2. Cabinet:
a. Material: Metal tub and door painted with red epoxy paint and white vinyl letters indicating “FIRE BLANKET”. Hardware to be zinc-plated.
b. Mounting: Surface

B. Roller-Type Fire Blanket Cabinet:
   1. Basis of Design: Royal Series Model 9519S21 as manufactured by J.L. Industries.
   2. Cabinet:
      a. Material: Metal tub and door painted with red epoxy paint and white vinyl letters indicating “FIRE BLANKET”. Hardware to be zinc-plated.
      b. Mounting: Surface.

2.5 ACCESSORIES

A. Fire Blanket: Fire retardant treated wool; red, 62 by 84 inch (1575 by 2135 mm) size complying with 16 CFR 1610..

B. Extinguisher Brackets: Formed steel, chrome-plated.

C. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

D. Cabinet Signage: _____.
   1. Lettering:Red 3/4 inch tall vertical oriented lettering stating “FIRE EXTINGUISHER” , in accordance with authorities having jurisdiction (AHJ)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Locate as indicated on Drawings, as directed by Owner, and as follows:
   1. Provide one Multipurpose Fire Extinguisher with wall bracket in each of the following locations:
      a. Mechanical Rooms.
      b. Electrical Rooms.
      c. MDF/IDF/Telecommunications Rooms.
      d. Fire Riser Rooms.
      e. Auditoriums of 4000 square feet or less.
   2. Provide one Multipurpose Fire Extinguisher with Partially-Recessed Fire Extringuisher Cabinet for every ____ square feet of space other than those listed above.

B. Install in accordance with manufacturer's instructions.

C. Install cabinets plumb and level in wall openings, ____ inches (____ mm) from finished floor to inside bottom of cabinet.

D. Secure rigidly in place.

E. Place extinguishers in cabinets.

F. Position cabinet signage at ____.

3.3 MAINTENANCE

A. Refer to Section 01 77 00 - Closeout Procedures for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide a separate maintenance contract for the service and maintenance of _____ for _____ years from Date of Substantial Completion.

END OF SECTION 10 44 00

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SECTION 10 51 13 - METAL LOCKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal lockers.

B. Firearm and Armory Rack.

C. Locker benches.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base construction.

B. Section 06 10 00 - Rough Carpentry: Wood base construction.

C. Section 06 10 00 - Rough Carpentry: Wood blocking and nailers.

D. Section 06 20 00 - Finish Carpentry: Bench tops for locker bench support brackets.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

D. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2012 (Reapproved 2017).

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

F. ASTM F1267 - Standard Specification for Metal, Expanded, Steel; 2018.

G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
   1. Wired Access Control: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
   1. Wired Access Control: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

D. Full Size Sample: One full-size locker of each construction specified for evaluation of construction.

E. Samples: Submit two samples 3 by 6 inches (75 by 150 mm) in size showing color and finish of metal locker material.

F. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience

manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. Art Metal Products: www.artmetalproducts.com/#sle.
2. ASI Storage Solutions: www.asi-storage.com/#sle.
3. DeBourgh Manufacturing Co: www.debourgh.com/#sle.
4. List Industries, Inc: www.listindustries.com/#sle.
5. Lockers MFG: www.lockersmfg.com/#sle.
6. Republic Storage Systems Co: www.republicstorage.com/#sle.
7. Tennsco Storage: www.tennsco.com/#sle.
8. WEC Manufacturing: www.itswec.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 LOCKER APPLICATIONS

A. Basis of Design: List Industries.
1. Type A: 12 inches W by 12 inches D by 72 inches H, 2 tier.
2. Type D: 15 inches W by 15 inches D by 72 inches H, 2 tier.
3. Type F: 12 inches W by 15 inches D by 72 inches H, 6 tier.
4. Type G: 18 inches W by 21 inches D by 72 inches H, 2 tier.
5. Type H: 15 inches W by 15 inches D by 72 inches H, 2 tier.

2.3 METAL LOCKERS

A. Accessibility: Design units indicated on drawings as 'accessible' to comply with ICC A117.1 and ADA Standards.

B. Locker Case Construction:
1. Heavy-Duty, Welded Construction: Made of formed and welded together sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
   a. Assembly: Do not use bolts, screws, or rivets to assemble locker bodies.
   b. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
      1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
         (a) Uncoated.
         (b) Zinc-Coated by the Hot-Dip Process: Comply with ASTM A653/A653M, coating designation G60/Z180.
         (c) Zinc-Iron-Alloy-Coated by the Hot-Dip Process: Comply with ASTM A653/A653M, coating designation A40/ZF120.
         (d) Zinc-Coated by the Electrolytic Process: Comply with ASTM A879/A879M, coating designation 30Z.
         (e) Perforations: Manufacturer's standard pattern of square holes.
      2) Expanded Steel Sheet: Made from ASTM A1008/A1008M carbon steel sheet and complying with ASTM F1267, Type II, expanded and flattened, style 3/4 - 16, with a minimum 70 percent open area.
         (a) Class 1, uncoated.
         (b) Class 2, hot-dip zinc-coated, galvanized or galvannealed.
      3) Body and Shelves: 16 gauge, 0.0598 inch (1.52 mm).
      4) Backs: 18 gauge, 0.0478 inch (1.21 mm).
      5) Base: 18 gauge, 0.0478 inch (1.21 mm).
         (a) Height: 4 inches (100 mm).
      6) Legs: Manufacturer's standard
         (a) Form by extending frame members.

(b) Fabricate from 14 gauge, 0.0747 inch (1.90 mm) nominal thickness steel sheet specified above, welded to bottom of locker.
(c) Height: 6 inches (152 mm).

c. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
1) Door Frame: 16 gauge, 0.0598 inch (1.52 mm), minimum.

d. Where ends or sides are exposed, provide flush panel closures.

e. Provide filler strips where indicated or required, securely attached to lockers.

2. Standard-Duty, Knocked Down Construction: Made of formed sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.

a. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
(a) Uncoated.
(b) Zinc-Coated by the Hot-Dip Process: Comply with ASTM A653/A653M, coating designation G60/Z180.
(c) Zinc-Iron-Alloy-Coated by the Hot-Dip Process: Comply with ASTM A653/A653M, coating designation A40/ZF120.
(d) Zinc-Coated by the Electrolytic Process: Comply with ASTM A879/A879M, coating designation 30Z.
(e) Perforations: Manufacturer's standard pattern of square holes.
2) Expanded Steel Sheet: Made from ASTM A1008/A1008M carbon steel sheet and complying with ASTM F1267, Type II, expanded and flattened, style 3/4 - 16, with a minimum 70 percent open area.
(a) Class 1, uncoated.
(b) Class 2, hot-dip zinc-coated, galvanized or galvannealed.
3) Body and Shelves: 24 gauge, 0.0239 inch (0.61 mm).
4) Backs: 24 gauge, 0.0239 inch (0.61 mm).
5) Base: 18 gauge, 0.0478 inch (1.21 mm).
(a) Height: 4 inch (100 mm).
6) Legs: Manufacturer's standard.
(a) Form by extending frame members.
(b) Fabricate from 14 gauge, 0.0747 inch (1.90 mm) nominal thickness steel sheet specified above, welded to bottom of locker.
(c) Height: 6 inches (152 mm).

b. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
1) Door Frame: 16 gauge, 0.0598 inch (1.52 mm), minimum.

c. Where ends or sides are exposed, provide flush panel closures.

d. Provide filler strips where indicated, securely attached to lockers.

C. Drawer Base with Bench:
1. Top, Bottom, Sides, Back, and Drawer: 16 gauge, 0.0598 inch (1.52 mm) sheet steel.
2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.
3. Integral self latching mechanism triggered by operation of wardrobe door.
4. Bench: Mixed hardwood.

D. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
1. Door Thickness: 16 gauge, 0.0598 inch (1.52 mm), minimum.
2. Form recess for operating handle and locking device.

E. Latches and Door Handles: Manufacturer's standard.
   1. Latching Components: 300 Series Stainless Steel (ASTM A240/A240M).
   2. Latching: Manufacturer's standard for locking arrangement selected.
      a. Three-Point Lift Handle Gravity Latch: Pocket-mounted, provide for doors 18 inches (457 mm) or taller.
         1) Handle Pocket, Recess: Stainless steel flush-mounted cup recessed into face of door.
         2) Handle: Steel finger lift mechanism with exposed portion encased in molded plastic trigger.
            (a) Padlock Eye: Integral with lift trigger, sized for use with 9/32 inch (7.1 mm) diameter padlock shackles.
         3) Latching Mechanism: Spring activated nylon slide latch enclosed in steel latch channel allows closing of door while padlock or built-in lock is in position.
         4) Lock Hole Filler Plate: Manufacturer's standard. Provide for lockers intended to be unsecured or secured with padlocks.
         5) Rubber bumpers riveted to door stops for silent operation.
      b. Three-Point Pull Handle Gravity Latch: Surface-mounted, provide for doors 18 inches (457 mm) or taller.
         1) Handle: Steel finger lift mechanism.
         2) Latching Mechanism: Spring activated nylon slide latch enclosed in steel latch channel allows closing of door while padlock or built-in lock is in position.
         3) Padlock Eye: Integral with lift handle, sized for use with 9/32 inch (7.1 mm) diameter padlock shackles.
         4) Lock Hole Filler Plate: Manufacturer's standard. Provide for lockers intended to be unsecured or secured with padlocks.
         5) Rubber bumpers riveted to door stops for silent operation.
      c. Three-Point/Three-Sided Cremone Latch.
         1) Latching mechanism operated by a steel handle welded to a three-point Cremone-type assembly.
         2) Latching rods, 3/8 inch (9.5 mm) diameter, engage top and bottom edge of locker frame. 3/16 inch (4.8 mm) thick center latch engages door jamb.
      d. Single-Point Latch: Provide for doors indicated.
         1) Stationary latch welded securely to locker frame.
         2) Latch extends no more than 1-1/4 inch (31.8 mm) into locker opening, penetrating through cup.
         3) Flush-mounted, recessed stainless steel cup in a formed door with 18 gauge, 0.0478 inch (1.21 mm) vertical back panel stiffener.
      e. Spring Latch: Provide for box-size lockers and where indicated.
         1) 16 gauge, 0.0598 inch (1.52 mm) cold rolled steel, zinc plated with a 10 gauge, 0.1345 inch (3.42 mm) latch and 16 gauge, 0.0598 inch (1.52 mm) stainless steel lock hasp and completely enclosed stainless steel spring.
         2) Assembled using six nickel-plated rivets.
         3) Equip box locker doors with a padlock hasp and a stainless steel strike plate with an integral handle pull. Box locker doors may also be equipped with built-in locks.
      f. Access Control Single-Point Latch: Provide for doors indicated.
         1) Wireless integrated access control locking devices.
         2) Stationary latch welded securely to locker frame.
         3) Rubber bumpers riveted to door stops for silent operation.

F. Cup, Pocket: Manufacturer's standard, with integral pull, and recessed surface punched for installation of lock, latch lift mechanism, and number plate.

G. Hinges: Continuous piano hinge with powder coat finish to match locker color.

H. Hinges: Heavy-duty, 7-knuckle type; two for doors under 42 inches (1050 mm) high; three for doors over 42 inches (1 050 mm) high.

I. Trim: 20 gauge, 0.0359 inch (0.91 mm).

J. Number Plates: Provide oval shaped aluminum plates. Form numbers ____ inch (____ mm) high of block font style with ADA designation, in contrasting color.

K. Locks: Contractor shall include combination padlocks with alternative key unlocking mechanisms for all lockers included in the construction documents. One combination padlock per locker space.

2.4 FIREARM AND ARMORY RACL

A. Metal Weapons Rack:
1. Basis of Design: Firearm and Armory Rack as manufactured by Tiffin Metal Products.
2. Size: 42 inches W by 26 inches D by 45 inches H.
3. Color: Black.
4. Doors: Diamond Perforated, retractable bi-fold door with locking mechanism.
5. Capacity: Holding and Securing 10 long rifles and 10 pistols.

2.5 LOCKER BENCHES

A. Basis of Design:
1. Model No. 942SM-V6 as manufactured by Belson.
2. Type: Backless Thermoplastic coated metal bench.

B. Locker Benches: Stationary type; bench top of 1-1/4" Maple with 2 coats of clear lacquer coating All corners shall be rounded and sanded; Powder-coated steel tubing with a 10 gauge steel flange. pedestals. Pedesal to be fastened to the floor with 3 lag screws per pedestal.
1. Accessibility: Comply with ICC A117.1 and ADA Standards.
2. Height: 18" inch (_____ mm).
3. Length: 42" inch (_____ mm).
4. Depth: 22" inch (_____ mm).
5. Powder-Coating Color: Selected by Architect from Manufacturer's full rage of colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

C. Verify that power and ethernet are installed and enabled. See manufacturer drawings for recommended outlet or junction box placement.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared 4" fully grouted CMU base concealed with rolled rubber base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds (445 N).

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install fittings if not factory installed.

H. Replace components that do not operate smoothly.

3.3 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION 10 51 13

SECTION 10 56 13 - METAL STORAGE SHELVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Four post shelving.

B. Cantilevered shelving.

C. Shelving accessories.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and reinforcement in walls for anchoring shelving units.

B. Section 09 21 16 - Gypsum Board Assemblies: Blocking and reinforcement in walls for anchoring shelving units.

C. Section 10 56 26 - Mobile Storage Shelving: Installation of metal storage shelving on mobile carriages.

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Rated uniform shelf loads.
   2. Details of shelving assemblies, including reinforcement.
   3. Accessories.
   4. Substrate preparation instructions and recommendations.
   5. Storage and handling requirements and recommendations.
   6. Installation methods.
   7. Specimen warranty.
   8. Maintenance methods.

C. Test Reports: Provide independent agency test reports documenting compliance with specified structural requirements.
   1. In lieu of test reports, detailed drawings stamped and sealed by a Professional Engineer, licensed in the state of Texas, will be acceptable.

D. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.
   1. Indicate methods of achieving specified anchoring requirements.

E. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 77 00 - Closeout Procedures, for additional provisions.
   2. Extra Shelves: Two of each size with shelf brackets.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum ____ years of documented experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspect for dents, scratches, or other damage. Replace damaged units.

B. Store in manufacturer's unopened packaging until ready for installation.

C. Store under cover and elevated above grade.

1.7 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures for additional warranty requirements.

B. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Four Post Shelving:
      a. ASI Storage Solutions: www.asi-storage.com/#sle.
      b. Hallowell: www.hallowell-list.com/#sle.
      c. List Industries, Inc: www.listindustries.com/#sle.
      d. Montel; SmartShelf: www.montel.com/#sle.
      e. Penco Products, Inc: www.pencoproducts.com/#sle.
      f. SpaceSaver Corporation: www.spacesaver.com/#sle.
      g. Tennsco Storage: www.tennsco.com/#sle.
      h. Dixie Shelving: www.dixieshelving.com/#sle.
   2. Cantilevered Shelving:
      a. Amorus

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 SHELVING - GENERAL

A. Refer to Drawings for layout and sizes.

B. Anchors: Provide anchoring hardware to secure each shelving unit to floor and wall.
   1. Provide hardware of type recommended by manufacturer for substrate.
   2. Refer to Drawings for additional details of anchorage.

2.3 FOUR POST SHELVING

A. Four Post Shelving: Steel post-and-shelf type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified.
   1. Basis of Design: Dixie shelving or Architect approved equal.
   2. Unit Width: As indicated on Drawings.,
   3. Shelf Capacity: Uniform distributed load of 600 Ibs, minimum.
   4. Adjustability of Shelving: Continuous along length of post.
   5. Shelf Depth: Indicated on Drawings.
   6. Unit Depth: Not more than 1/4 inch (6 mm) greater than shelf depth.
   7. Shelves per Unit: 9.
   8. Unit Height: 84 Inches, overall, maximum.
   9. Finish: Powder Coat.
      a. Color: Manufacturer's standard gray.
   10. Provide single-face and double-face units where indicated.
   11. Number of Units: As indicated on Drawings.

B. Heavy-Duty Four Post Shelving:
   1. Basis of Design: Dixie Shelving or Architect Approved Equal.

2. Type: Post and Shelf.
3. Unit Width: 36 inches.
4. Capacity: 800 lbs.
5. Beacm Capacity: 800 lbs.
6. Shelf Adjustability: Continious along length of post.
7. Shelf Depth: 18 inches.
8. Unit Depth: Not more than 1/4 more than shelf depth.
9. Shelves Per Unit: 3.
10. Unit Height: 84 inches maximum.
11. Finish: Galvanized.

C. Posts: Formed sheet members; perforations exposed on face of members are not acceptable.
1. Metal Thickness: 16 gauge, 0.0598 inch (1.52 mm).
2. Post Shape: Tee intermediate posts, angle end posts forming corners.
3. Post Face Width: 2 inches (51 mm), maximum.
4. Connecting Hardware: Manufacturer's standard.
5. Post Bases: Flat steel foot plate.

D. Bracing: Formed sheet members.
1. Back Sway Bracing: Strap type; at back of each unit.
2. Side Sway Bracing: Strap type; at each side of each unit.
3. Strap Sway Bracing: One strap installed diagonally, 16 gauge, 0.0598 inch (1.52 mm); welded, riveted, or bolted to uprights.
4. Refer to Drawings for additional details of bracing.

2.4 CANTILEVERED SHELVING

A. Cantilevered Shelving: Freestanding formed steel post frame with slots for cantilevered shelving brackets, shelving brackets, shelving surfaces, and accessories as specified.
1. Basis of Design: Racking Storage System as manufactured by Armoruso Racking.
2. Column Height: 120 inches.
3. Column Bases: 60 inches Deep.
4. I-Beam Dimensions: 4 inches High by 60 inches Long.
5. Three arms and base provided for each column.
6. Number of Units: As indicated on Drawings.
7. Location: Refer to Drawings.

2.5 ACCESSORIES

A. Kick Plates: Formed sheet metal; enclose open space between bottom shelf and floor on all front sides and open ends; finished to match.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate is level and that clearances are as specified.

B. Verify that walls are suitable for shelving attachment.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.

C. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.

D. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch (3 mm) difference in distance between bottom shelf and canopy top, measured along any post in any direction.

3.4 CLEANING

A. Clean shelving and surrounding area after installation.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 10 56 13

SECTION 10 56 17 - WALL-MOUNTED STANDARDS AND SHELVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Steel shelf standards, brackets, and accessories.

B. Steel shelf support brackets.

C. Closet rods for mounting on brackets.

D. Shelves.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking in walls for attachment of standards.

B. Section 06 20 00 - Finish Carpentry: Wood shelves.

C. Section 09 21 16 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.4 SUBMITTALS

A. Refer to Section01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 77 00 - Closeout Procedures for additional provisions.
   2. Extra Brackets: Ten of each size of standard straight bracket.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover and elevated above grade.

B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Steel Shelf Standards and Brackets:
      a. Knape & Vogt Manufacturing Company; 87™/187™ Series: www.knapeandvogt.com/#sle.
   2. Aluminum Shelf Standards, Brackets, and Accessories:
      a. Rakks/Rangine Corporation; _____: www.rakks.com/#sle.
   3. Steel Shelf Support Brackets:
      a. Centerline Brackets; Floating Wall Mount: www.countertopbracket.com/#sle.
   4. Shelving:
      a. Rakks/Rangine Corporation; Aluminum Shelving: www.rakks.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 COMPONENTS

A. Steel Shelf Standards, Brackets, and Accessories:
   1. Shelf Standard Accessories:
      a. At shelves indicated as sloping provide adjustable slant brackets.
      b. Where cornices are indicated as part of shelving provide cornice brackets.
      c. Where shelves are indicated to be fastened to brackets provide brackets with flanges for screwing into end of shelf, steel shelf rests, or flanged brackets; fasten with screws.
      d. At glass shelves provide clear plastic shelf rests, front and back, with rubber cushions.
      e. Provide other accessories as indicated.
   2. Closet Rods: Steel tubing for wall mounting in flange fittings.
      a. Type: Round stainless steel, standard duty; 1-1/16 inch (27 mm) outside diameter, 0.087 inch (2.21 mm) wall thickness.
      b. Length: As required for application, up to 12 feet (3655 mm).
      c. Provide mounting fittings to suit application.

B. Steel Shelf Support Brackets:
   1. Material: Steel, ASTM A36/A36M.
   2. Bracket Type: L-shaped, with predrilled mounting holes on vertical leg for attachment to wood stud or blocking.
   3. Bracket Horizontal Support Length: Refer to Drawings.
   4. Finish: Silver powdercoat.

C. Shelves:
   1. Laminate Faced Shelves: Particleboard or medium density fiberboard covered with high pressure decorative laminate on both sides.
      a. Edge Finish: Matching laminate, all four edges.
      b. Substrate Thickness: 1-1/2" inch (38.1 mm), nominal.
      c. Length: As indicated on drawings.
      d. Laminate: NEMA LD 3 Type HGL.
      e. Laminate Color and Pattern: To be selected by Architect from manufacturer's Wilsonart 5033-38 Handspun Pearl line.

D. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions. Finish of exposed to view fasteners to match finish of standards and other components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount standards or brackets to solid backing capable of supporting intended loads.

C. Install brackets, shelving, and accessories.

D. Provide double sided foam tape between adjoining sections of aluminum shelving to maintain alignment.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 56 17

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SECTION 10 71 13.43 - FIXED SUN SCREENS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Modular, shop fabricated, extruded aluminum sun screens to be mounted on structure provided by others.

1.2 RELATED REQUIREMENTS

A. Section 07 42 13 - Metal Wall Panels: Mounting substrates.

B. Section 08 44 13 - Glazed Aluminum Curtain Walls: Mounting substrates.

C. Section 08 51 13 - Aluminum Windows: Mounting substrates.

1.3 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2021a.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

F. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing all profiles, sections of all components, finishes, fastening details, and manufacturer's technical and descriptive data. Include field dimensions of openings and elevations on shop drawings.

C. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

D. Samples: 10 inches (254 mm) by 10 inches (254 mm) minimum illustrating design, workmanship and finish color.

E. Sample of Louver: For review of shape only.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Specimen Warranty: Furnish a copy of manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with no less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.7 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Sun Screens: Correct defective work within a one year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Fixed Aluminum Sun Screens:
      a. Same manufacturer as curtain wall to which sun screens are to be attached.
      b. YKK AP America Inc: www.ykkap.com/#sle.
      c. Kawneer: www.kawneer.us/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 SUN SCREENS

A. Aluminum Sun Screens: Shop fabricated, shop finished, extruded aluminum outriggers, louvers, and fascia, free of defects impairing strength, durability or appearance.
   1. Basis of Design: Versoleil Sunshade Outrigger System manufactured by Kawneer or Architect approved equal..
   2. Configuration: As indicated on drawings.
   3. Louver Type: Slat.
   4. Sun Screen Angle: As indicated on Drawings.
   5. Outrigger Shape: Planar.
   6. Design Criteria: Design and fabricate to resist the following loads without failure, damage, or permanent deflection.
   7. Sizes: As indicated on Drawings.
   8. Exposed Aluminum Finish: Dark Bronze.
   9. Provide a complete system ready for erection at project site.
   10. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

2.3 MATERIALS

A. Aluminum Extrusions: ASTM B209/B209M or ASTM B221 (ASTM B221M).

B. Aluminum Coated Steel Sheet: ASTM A792/A792M.

C. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.

D. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel.

2.4 FINISHES

A. Finish Color: Dark Bronze Anodized.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that dimensions of supporting structure are within plus/minus 1/8 inch (3.175 mm) of dimensions indicated on shop drawings.

C. Verify that all adjacent painting, roofing, masonry work, and other work that might damage sun screen finish has been completed prior to installation of sun screens.

D. Do not install until after all adjacent painting, roofing and masonry have been completed.

E. Do not proceed with installation until all conditions are satisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Set units level, plumb, with uniform joints, and aligned with building elements.

C. Separate dissimilar metals using concealed bituminous paint or non-absorbent gasket.

D. Anchor units to structure as indicated on drawings.

E. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

F. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.3 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch (3.175 mm).

3.4 CLEANING

A. Clean exterior surfaces units of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.5 PROTECTION

A. Protect units after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION 10 71 13.43

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SECTION 10 73 16.13 - METAL CANOPIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Freestanding, shop-fabricated metal canopies.
   2. Freestanding, shop-fabricated walkway covers.
   3. Accessories necessary for a complete application.

B. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete: Concrete footings.
   2. Section 07 72 00 - Roof Accessories: Gutters and downspouts.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2021, with Editorial Revision.

F. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

H. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

K. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings; 2020.

L. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

M. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

N. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

O. ASTM E2950 - Standard Specification for Metal Canopy Systems; 2014 (Reapproved 2020).

P. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.

Q. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi

Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

R. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details.

D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

G. Erector's Qualification Statement.

H. Welders’ Qualification Statement: Welders’ certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
   1. Comply with applicable code for submission of design calculations as required for acquiring permits.
   2. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform work in accordance with AISC 303.
   1. Maintain one copy on site.

C. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Not less than three years of documented experience.

D. Erector Qualifications: Company specializing in performing the work of this section.
   1. Not less than three years of documented experience and approved by canopy manufacturer.

E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.7 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Aluminum Systems:
      a. AVAdek, Inc.: www.avadek.com/#sle.
      b. Aluminum Techniques.
      c. Canopy Solutions.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 SHOP FABRICATED ALUMINUM CANOPIES AND WALKWAY COVERS

A. Pre-engineered system complying with ASTM E2950.

B. Design and fabricate metal canopy system to resist wind and live loads without failure, damage, or permanent deflection in accordance with ASCE 7:
   1. Loads: As indicated on Drawings.

C. Thermal Movement: Design system to accommodate thermal movement caused by ambient temperature range of 120 degrees F (49 degrees C) and surface temperature range of 180 degrees F (82 degrees C) without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

D. Configuration: As indicated on Drawings.

2.3 COMPONENTS

A. Aluminum:
   1. Sheet and Plate: ASTM B209/B209M.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221/ASTM B221M, Alloy 6063-T5/T52.
   3. Extruded Structural Pipe and Tubes: ASTM B429/B429M, Alloy 6063-T6.
   4. Structural Profiles: ASTM B308/B308M.
   5. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
   6. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.
   7. Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.
   8. Die and Hand Forgings: ASTM B247/ASTM B247M, Alloy 6061-T6.
   9. Castings: ASTM B26/B26M, Alloy A356.0-T6.

B. Anchor Bolts: ASTM A307 or ASTM A572/A572M, formed with bent shank, assembled with template for casting into concrete.
   1. Minimum exposed thread of 7 inches (178 mm) above footing and 23 inch (584 mm) minimum embedment.
   2. Provide nuts and washers as required for column leveling and plumbing.

C. Concrete Footings: Refer to Structural for additional requirements.

D. Exposed Gutters and Downspouts: Galvanized steel with baked enamel finish, color to match canopy covering, manufacturer's recommended size for canopy specified.
   1. Refer to Section 07 72 00 - Roof Accessories for additional requirements.

2.4 SHOP FABRICATION

A. Provide a complete system ready for erection at project site.

B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

C. Perform welding in accordance with AWS D1.1/D1.1M.

D. Fabricate connections for bolt, nut, and washer connectors.

2.5 FINISHES

A. Structural Aluminum Components:
   1. Fluoropolymer finish; color _____.
      a. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
         1) Field Finish: Charcoal.
         2) Soffit Finish: Southern Pecan.

2.6 ACCESSORIES

A. Structural Bolts: ASTM F3125/F3125M, Grade A325, minimum 3/4 inch (19 mm) diameter.

B. Trim, Closure Pieces, and Flashings: Same material, thickness and finish as sheet metal decking; factory-fabricated to required profiles.
   1. Exposed Fasteners: Not permitted.

C. Grout: ASTM C1107/C1107M; non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.

D. Fasteners, Non-Structural: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that foundation, electrical utilities, and placed anchors are in correct position.

C. Verify that bearing surfaces are ready to receive this work.

D. Do not proceed with installation until all conditions are satisfactory.

3.2 INSTALLATION - FRAMING

A. Erect framing in accordance with AISC 303.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Fasten columns to anchor bolts.

E. Do not field cut or alter structural members without approval.

F. After erection, prime welds, abrasions, and surfaces not shop primed.

3.3 INSTALLATION - CANOPY COVERING

A. Install in accordance with manufacturer's instructions.

B. Fasten metal decking to steel support members, aligned level and plumb.

C. Install fascia panels, trim, and flashing.

D. Separate dissimilar metals using concealed bituminous paint.

E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.4 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch (3.175 mm).

3.5 CLEANING

A. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.6 PROTECTION

A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION 10 73 16.13

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SECTION 10 75 16 - FLAGPOLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Ground set flagpoles made from aluminum.
   2. Fittings, base, anchorage.
   3. Flags.
   4. Accessories necessary for a complete installation,

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, currently licensed to practice within jurisdiction of the project location, with experience in the design of curtainwalls and aluminum storefronts to design ground set flagpoles using performance requirements and design criteria indicated.

B. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
   1. Wind Loads: Refer to the Structural Engineer's drawings.
   2. Base flagpole design on polyester, nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.4 SUBMITTALS

A. Product Data: Technical data for flagpoles including construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Shop Drawings: Submit plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support, including section, and details of foundation system.

C. Delegated Design Submittal.

D. Operation and Maintenance Data: Submit data to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements: Comply with applicable requirements.
      a. United States Access Board Americans with Disabilities Act Accessibility Guidelines (ADAAG) (2010 ADA Standards for Accessible Design).
      b. ICC A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS) 2012 or United States Access Board Americans with Disabilities Act Accessibility Guidelines (ADAAG) (2010 ADA Standards for Accessible Design).

B. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Acme/Lingo Flagpoles, LLC.
   2. American Flagpole.
   3. Baartol Company.
   4. Carrot-Top Industries, Inc.
   5. Concord American Flagpole.
   6. Eder Flag Manufacturing Company, Inc.
   7. Ewing Flagpoles.
   8. Morgan-Francis Flagpoles and Accessories.
   9. Pole-Tech Company Inc.
   10. U.S. Flag & Flagpole Supply, LP.

2.2 ALUMINUM FLAGPOLES

A. Basis of Design: Concord American Flagpole.

B. Aluminum Flagpoles: Cone tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch (4.8 mm).

C. Exposed Height: 35 feet (11 m).

D. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
   2. Provide flush hairline joints using self aligning, snug fitting, internal sleeves.

E. Metal Foundation Tube: Corrugated steel foundation tube, 0.060 inch (1.52 mm) wall thickness with 3/16 inch (4.8 mm) steel bottom plate and support plate; 3/4 inch (19 mm) diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
   1. Flashing Collar: Same material and finish as flagpole.

F. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
   1. Flashing Collar: Same material and finish as flagpole.

G. Cast Metal Shoe Base: Made from aluminum with same finish and color as flagpoles for anchor bolt mounting; furnish with anchor bolts.
   1. Furnish ground spike.

H. Hinged Baseplate: Cast metal tilting hinged base and anchor plate joined by permanently secured pivot rod. Furnish with stainless steel screws for securing tilting base to anchor plate when not tilted; furnish with anchor bolts.
   1. Finish: Same as flagpole.
   2. Furnish aluminum base or aluminum flashing collar finished to match flagpole.
   3. Furnish ground spike.

I. Pivoting Tilt Base: Steel baseplate with channel or rectangular tube uprights, pivot bolt, and locking device for tilting flagpole. Furnish tilting flagpole with steel counterweight box and weights, or furnish with internal counterweight. Furnish base with anchor bolts.
   1. Finish: Same as flagpole.
   2. Furnish ground spike.

2.3 FITTINGS

A. Finial Ball: Flush seam ball, sized to match flagpole butt diameter.
   1. 3 inch (1.6 mm) spun aluminum, finished to match flagpole.

B. Internal Halyard, Cam Cleat System: 5/16 inch (8 mm) diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
   1. Halyard Flag Snaps: Chromium plated bronze or stainless steel or bronze or nylon swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

2.4 MISCELLANEOUS MATERIALS

A. Flag: One 6’0” x 10’0” US flag and one 6’0” x 10’0” Texas or United States of America flag each to be made of polyester fabric with brass grommets.

B. Concrete: Quick set concrete composed of not less than five (5) sacks of Portland cement conforming to ASTM C150, per cubic yard of wet concrete combined with fine aggregate, clean water, and mixed in proportions to attain minimum 28 day compressive strength of not less than 3,000 psi.

C. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

D. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

E. Sand: ASTM C 33/C 33M, fine aggregate.

F. Elastomeric Joint Sealant: Single component nonsag urethane joint sealant complying with requirements in Section 079200.

G. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.5 FINISH

A. Dark Bronze Anodized Finish: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 White Metal Blast Cleaning or SSPC-SP 8, Pickling. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. After cleaning and pretreating, apply two coat, baked on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.

G. Concrete: Place concrete as specified in Section 03 30 00. Compact concrete in place by using vibrators. Moist cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

H. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.

B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

D. Provide positive lightning ground.

3.3 CLEANING AND ADJUSTING

A. Clean area of debris and place excavated soil where directed or remove from site as directed. Clean flagpole of dirt and foreign matter which will affect appearance.

B. Touch up damage to finished surfaces with manufacturer’s matching paint.

C. Adjust fittings for smooth operation.

END OF SECTION 10 75 16

SECTION 10 82 13 - EXTERIOR GRILLES AND SCREENS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior aluminum grilles and screens attached to structure.

B. Framed exterior polycarbonate mesh screens to be mounted on structure provided by others.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Mounting substrates.

B. Section 04 20 00 - Unit Masonry: Mounting substrates.

C. Section 05 12 00 - Structural Steel Framing: Mounting substrates.

D. Section 07 42 13 - Metal Wall Panels: Mounting substrates.

E. Section 08 43 13 - Aluminum-Framed Storefronts: Mounting substrates.

F. Section 08 44 13 - Glazed Aluminum Curtain Walls: Mounting substrates.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2017a.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

E. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

G. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2021a.

H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

L. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2018.

M. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).

N. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2020.

O. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics; 2019.

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

Q. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.

R. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2017.

S. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

T. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Submit detailed shop drawings, indicating component profiles, sections, finishes, fastening details, special details, and manufacturer's technical and descriptive data.
   1. Include field dimensions of openings and elevations on shop drawings.
   2. Indicate distinction between factory-assembled and field-assembled work on shop drawings.

C. Samples: Submit samples for color verification, 10 inches (254 mm) by 10 inches (254 mm) minimum.

D. Samples: Submit assembled sample 24 inches by 24 inches (610 mm by 610 mm) minimum size to illustrate design, fabrication techniques, workmanship, and finish color.

E. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

F. Designer's Qualification Statement.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packaging, with labels clearly identifying manufacturer and material.

B. Store materials indoors, protected from moisture, humidity, and extreme temperature fluctuations.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a one year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's ten year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Exterior Aluminum Grilles and Screens:
   1. Architectural Grilles & Sunshades, Inc: www.agsshade.com/#sle.
   2. Construction Specialties, Inc; Geometric Grilles: www.c-sgroup.com/#sle.
   3. DAMS Incorporated; TU Series: www.damsinc.com/#sle.
   4. Industrial Louvers, Inc; Model 450XPI: www.industriallouvers.com/#sle.
   5. Metalwerks; Screenwalls: www.metalwerksusa.com/#sle.
   6. Nelson Industrial, Inc: www.nelsonii.com/arch/#sle.
   7. Ruskin Company: www.ruskin.com/#sle.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 GRILLES

A. Extruded Aluminum Horizontal Blade Equipment Screens.
   1. Fabrication.
      a. Model: 450XPI as manufactured by Industrial Louvers, Inc..
      b. Style: Horizontal.
      c. Material: Extruded aluminum, 6063-T6.
      d. Wall thickness: 0.081 inch (2.1 mm), nominal.
      e. Angle: 40 degrees.
      f. Centers: 5 inches (127 mm), nominal.
      g. Supports: As required per wind load.
      h. Finish: Architect to select from manufactuer's full range.
   2. Panel Size and Configuration: As indicated on drawings.
   3. Frame/Support: Extruded aluminum tube or flat aluminum bar.

2.3 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M) alloy 6063, temper T5, 1/8 inch (3 mm) minimum wall thickness.

B. Aluminum Sheet: ASTM B209 (ASTM B209M) alloy 5005, with temper as required for forming.

C. Aluminum Coated Steel Sheet: ASTM A792/A792M.

D. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.

2.4 FABRICATION

A. Shop fabricate grilles and screens to the greatest extent possible.

B. Disassemble as necessary for shipping and handling, clearly mark units for proper reassembly.

C. Provide supports, anchorages, and accessories as required for complete assembled system.

D. Provide inserts as required for installation into concrete or masonry based support materials.

E. Fabricate grilles to ensure proper fit into openings of sizes indicated, with tolerances for installation.

F. Attach grille panels to each other by welding, unless otherwise indicated.

2.5 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

C. Natural Anodized Finish with Organic Seal: AAMA 612 Clear anodic coating with non-aqueous electro-deposited organic seal; not less than 0.7 mils (0.018 mm) thick.

D. Color Anodized Finish with Organic Seal: AAMA 612 Electrolytically deposited colored anodic coating with non-aqueous electro-deposited organic seal; not less than 0.7 mils (0.018 mm).

E. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

F. Superior Performing Organic Coatings: AAMA 2605; multiple coats, thermally cured polyvinylidene fluoride system.

G. Finish Color: As indicated on drawings.

H. Finish Color: As selected by Architect from manufacturer's standard color range.

2.6 ACCESSORIES

A. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel, sizes to suit installation conditions.

B. Anchors and Inserts: Corrosion resistant; type, size, and material required for loading and installation as indicated.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that painting, roofing, masonry work, and other adjacent work that might damage grille finish have been completed prior to start of installation.

C. Verify that anchorage devices have been properly installed and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint, and allow paint to dry prior to installation of aluminum components.

C. Set grilles level, plumb, with uniform joints, and in alignment with adjacent work as indicated.

D. Mechanically secure grilles to supporting structure.

E. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

3.3 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch (3 mm).

B. Maximum Offset From True Alignment: 1/8 inch (3 mm).

3.4 CLEANING

A. Remove temporary protective covering as grilles are installed.

B. Clean finished surfaces as recommended by manufacturer and maintain clean condition until Date of Substantial Completion.

C. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

D. Replace grilles that have been damaged beyond touch-up repair.

3.5 PROTECTION

A. Protect installed grilles to ensure grilles are without damage until Date of Substantial Completion.

END OF SECTION 10 82 13

SECTION 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 05 83 - Wiring Connections: Electrical connections for appliances.

1.3 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.1 KITCHEN APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Refrigerator: Free-standing,.
   1. Basis of Design: GIE21GSHSS as manufactured by GE.
   2. Capacity: Total minimum storage of 21.0 Cuy. Ft.; minimum 15 percent freezer capacity.
   3. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE).
   4. Features: Include glass shelves and light in freezer compartment.
   5. Exterior Finish: Stainless steel, color as indicated.
   6. Manufacturers:
      a. Frigidaire Home Products: www.frigidaire.com/#sle.
      b. GE Appliances: www.geappliances.com/#sle.
      c. Whirlpool Corp: www.whirlpool.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Commercial Refrigerator:
   1. Basis of Design: TS-49-HC as manufactured by True Food Service.

2. Finish: Stainless Steel.
3. Doors: Two (2).
4. Electrical: 115V/60Hz/1-ph.
5. Temperature Range: 33-38 degress.
6. LED Interior LIghts.
7. Amperage: 5.4.
8. Size (inches): 54.13 Width by 29.5 Depth by 78.38 Height.

D. Range: Electric, free-standing, with glass-ceramic cooktop.
1. Basis of Design: Model JB750DJSS as manufactured by GE Appliances.
2. Size: 30 inches (762 mm) wide.
3. Oven: Self-cleaning with electronic ignition.
4. Elements: Four (4).
5. Controls: Solid state electronic.
6. Features: Include oven door window, oven light, and delay bake option..
7. Exterior Finish: Stainless steel, color white.
8. Manufacturers:
   a. Frigidaire Home Products: www.frigidaire.com/#sle.
   b. GE Appliances: www.geappliances.com/#sle.
   c. Whirlpool Corp: www.whirlpool.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Cooking Exhaust, Under Cabinet: Range hood.
1. Basis of Design: Model JV5300SJSS as manufactured by GE.
2. Size: 30 inches (762 mm) wide.
3. Fan: Two-speed, 500 cfm (236 L/s)
4. Exhaust: Rectangular.
5. Features: Include cooktop light and Remote Control.
6. Exterior Finish: Stainless steel, color white.
7. Manufacturers:
   a. Broan-NuTone, LLC: www.broan-nutone.com/#sle.
   b. Frigidaire Home Products: www.frigidaire.com/#sle.
   c. GE Appliances: www.geappliances.com/#sle.
   d. Whirlpool Corp: www.whirlpool.com/#sle.
   e. Substitutions: See Section 01 60 00 - Product Requirements.

F. Microwave: Countertop.
1. Basis of Design: Model PES7227SLSS as manufactured by GE.
2. Capacity: 2.2 cu.ft..
3. Power: 1100 watts.
4. Features: Include Clock saver, Timer On/Off, Cook Time, Start/Pause, Sound, Turntable
5. Exterior Finish: Stainless Steel.
6. Manufacturers:
   a. Frigidaire Home Products: www.frigidaire.com/#sle.
   b. GE Appliances: www.geappliances.com/#sle.
   c. Whirlpool Corp: www.whirlpool.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

G. Dishwasher: Undercounter.
1. Basis of Design: Model SGE53C55UC as manufactured by Bosch.
2. Controls: Solid state electronic.
3. Wash Levels: Five.
4. Cycles: Four (4), including normal and rinse and hold.
5. Features: Include Water softener, childlock, 24h delay start timer and Leak protection system..

6. Finish: Stainless Steel.
7. Manufacturers:
   a. Frigidaire Home Products: www.frigidaire.com/#sle.
   b. GE Appliances: www.geappliances.com/#sle.
   c. Whirlpool Corp: www.whirlpool.com/#sle.
   d. Bosch: www.bosch-home.com/#sle.
   e. Substitutions: See Section 01 60 00 - Product Requirements.

H. Commerical Freezer:
1. Basis of Design: Model TRLCLM-49F-FS-LR as manufactured by Traulsen.
2. Type: Double Door, Reach-In.
3. Dimensions: 78 inches H by 33 inches W by 55.75 inches D.
4. Hertz: 60 Hz.
5. Phase: 1.
6. Voltage: 115 V.
7. Location and Qunatity: Refer to Drawings.

2.2 LAUNDRY APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Clothes Washer: Front-loading.
1. Basis of Design: Model GFW480SPKDG as manufactured by GE.
2. Size: Full-size.
3. Controls: Rotary.
4. Cycles: Include normal, delicate, and Quick Wash, Tub Clean, Sanitize and Allergen..
5. Motor Speed: Single-speed.
6. Features: Include optional second rinse, bleach dispenser, fabric softener dispenser, and end of cycle signal.
7. Finish: Painted steel , color as scheduled.
8. Manufacturers:
   a. Frigidaire Home Products: www.frigidaire.com/#sle.
   b. GE Appliances; : www.geappliances.com/#sle.
   c. Whirlpool Corp: www.whirlpool.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Clothes Dryer: Electric, stationary.
1. Basis of Design: GFD48ESPKDG as manufactured by GE.
2. Size: Full-size.
3. Controls: Rotary, with timer dry control.
4. Temperature Selections: One.
5. Cycles: Include normal, knit/delicate, and air only.
6. Features: Include end of cycle signal and Control Lock..
7. Finish: Painted steel , color as scheduled.
8. Manufacturers:
   a. Frigidaire Home Products: www.frigidaire.com/#sle.
   b. GE Appliances: www.geappliances.com/#sle.
   c. Whirlpool Corp: www.whirlpool.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.3 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.4 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION 11 30 13

11 40 00 – FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SUMMARY OF THE WORK

A. Project Name and Location: Middle School 8
3280 Tiger Run, Brookshire, TX 77423

B. Approval of Working Surface: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory conditions. The beginning of work by any contractor shall constitute acceptance of the previous work.

C. Field Verification of All Dimensions: Before ordering any materials or doing any work, field verify all measurements of the building and be responsible for their accuracy. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect or Foodservice Design Professionals (FDP) for instructions before proceeding.

D. Cutting and Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the written approval of the Architect. Each Contractor shall leave all chases and openings straight, true, and of the proper size in their work, as may be necessary for the proper installation of their and other contractors' work. After such work has been installed, the contractor shall carefully fit around, close, repair, patch, and point up the same as directed to the satisfaction of the Architect.

E. Cooperation: The General Contractor, all other contractors, and all subcontractors shall coordinate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all the other trades every reasonable opportunity to install their work and store their material.

F. Inspection and Tests: The architect, Owner, Foodservice Design Professionals (FDP), and their representative shall always have access to the work, whether in preparation or progress. Provide proper and safe facilities for such access and inspection.

G. Fees, Permits, and Inspections: Secure and pay fees for all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, codes, rules, regulations, and contract requirements bearing on the work.

1.3 SCOPE OF WORK

A. Include the Work specified, shown, or inferable as part of Food Service Equipment. Portions of this Work may be subcontracted to those qualified to do such work as necessary because of jurisdictional trade agreements and restrictions.

B. The General Contractor is responsible for Related Work specified in other Sections: i.e., final plumbing, electrical and mechanical connections. The Kitchen Equipment Contractor (KEC) is responsible for all internal connections.

C. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up, and equipment adjustment in this contract. Plans and specifications shall be considered mutually explanatory. Work required by one, but not by the other, shall be performed as though required by both. Items required by one but not by the other shall be provided as though required by both. Work shall be accomplished as called for in specifications and shown on drawings so that all equipment items shall be entirely functional for the purpose for which they were designed and intended. Provide all necessary material, tools, equipment, and labor required for the complete delivery, un-crating, erection, and installation as designated on the food service equipment plan and, in the specifications, to be made ready for final connection by the appropriate Division contractors. When there is any discrepancy between drawings and specifications, bidders should seek clarification of any discrepancies from the Architect and or Foodservice Design Professionals (FDP) before bidding.

D. Should the drawings disagree in themselves or the specifications with the drawings *(and clarification was not sought before bidding)*, the higher cost, better quality, more stringent, and greater quantity of the work or materials shall be completed without additional costs to the Owner.

1.4 OTHER DIVISIONS/CONTRACTORS RELATED WORK

A. Division 03 (Concrete) is responsible for but not limited to:

1. Slab depressions reinforced concrete wearing bed at prefabricated walk-in assemblies.

2. Concrete or masonry platforms (with a finished top and coved base at the perimeter) for the raised setting of food service equipment.

3. Slab depressions to receive stainless steel drain trench liner/grate assemblies (provided under this Section).

B. Division 09 (Finishes) responsible for but not limited to:

1. Interior finished floor with a coved base at prefabricated walk-in assemblies.

C. Division 10 (Specialties) responsible for but not limited to:

1. S/S Corner Guards throughout the kitchen (unless specified otherwise).

2. Lockers.

D. Division 22 (Plumbing) is responsible for but not limited to:

1. All connections shall be made in accordance with local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty PVC and wide-sweep bends for refrigerant piping to beverage lines, Co2 lines, and remote food service equipment refrigeration systems.

3. Rough-in and final connection of plumbing systems to food service equipment and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 22. This includes but is not limited to the installation of all faucets (water fill faucets, pre-rinse faucets, etc.), hoses, gas disconnects and drains from the equipment point of connection to building plumbing systems. All drain lines are provided and installed by Div. 22.

a. Kitchen Equipment Contractor is responsible for providing all faucets (water fill faucets, pre-rinse faucets, etc.), drain fittings, mixing valves, control valves, water pressure regulators, vacuum breakers, and all accessories for equipment specified under 11 40 00. Division 22 is responsible for installation.

4. Indirect drain line runs from the equipment to the nearest drain or floor sink—lines to be type 'K' Copper.

5. If any plumbing accessories or fittings are provided loose with equipment by 11 40 00, Div. 22 is to attach to equipment and provide final connection.

6. Gas Supply Systems with all components and fittings required for a complete system.

7. Water Supply Systems with all components and fittings required for a complete system.

8. Compressed Air Systems with all components and fittings required for a complete system (if required for this project).

9. Piping and Drainage Systems (Sanitary and Grease-laden). ***Systems must be cleaned and flushed before the final connection with food service equipment - Critical.***

10. Floor Sinks (Provide and Install). Flange and grates to be flush with the finished floor.

11. Floor Drains (Provide and Install). Flange and grates to be flush with the finished floor.

12. Trench Drains (Provide and Install). Trench Liners provided by 11 40 00. Flange and liners to be flush with the finished floor.

13. Grease Traps as required (Size, Provide, Locate, and Install). Verify with local codes to bypass or pipe through Grease Trap and/or Interceptor.

14. P-Traps as required (including all disposers).

15. Interconnect water through Water Filter (Filter provided by 11 40 00 unless otherwise specified) to equipment.

16. Gas Quick Disconnect Installation (Quick Disconnect provided by 11 40 00).

17. Safety Restraint Cable Installation (Safety Restraint Cable Provided by 11 40 00).

18. Specified couplings and piping to all equipment furnished by 11 40 00.

19. Air Compressors (if required for this project) (Size, Provide, and Install unless otherwise specified).

20. Water Softeners (if required for this project) (Size, Provide, and Install unless otherwise specified).

21. Pressure Boilers (if required for this project) (Size, Provide, and Install unless otherwise specified).

22. Hand Sinks (Provide (unless otherwise specified) and Install). Provide a hot water tempering valve if required. Water temperature to be at least 100 degrees and flow for at least 20 seconds.

23. Ice Bin Drain Insulation (if Ice Machine is provided in this project) (Provide and Install).

24. Unions at disposer solenoid valves (if Disposer is provided in this project) (Provide and Install).

25. Back Flow Prevention as required (Provide and Install - including all disposers). Back-Siphonage shall be installed at all fixtures and equipment where backflow and/or back-siphonage may occur and where a minimum air gap cannot be provided between the water to the fixture or equipment at its flood/level rim. When furnished with equipment, vacuum breakers shall override the above if acceptable with applicable codes. Division 22 is responsible for verifying requirements with local codes.

26. Janitor Sink with Faucet (Provide and Install).

27. Freeze Proof Hydrant at the exterior of the building by receiving door (Provide and Install - unless otherwise specified).

28. Reverse Osmosis Systems (Size, Provide (unless otherwise specified), Locate, and Install).

29. All piping within the counter body or under fabricated counters must be run to a connection point below the counter body by Section 11 40 00—final connection by Division 22.

30. Exhaust Hood condensate drain connections (if Exhaust Hood is provided in this project) (Provide and Install).

31. Interconnection of ½" CW to Pre-Rinse and Disposers cone/body inlets piped through the solenoid and vacuum breaker (if Disposer is provided in this project).

32. Fire System Piping. The exposed piping is to be chrome plated.

33. Pipe ½" cold water to swirl inlets at disposers (if Disposer is provided in this project).

34. Water Treatment for Ice Builders (Non-Chlorinated water with a PH Level of 10 or Higher) and any drains and overflows. Piping from Ice Builders to Tumble Chillers by Div. 23 (if Ice Builders and Tumble Chillers are provided in this project).

35. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

E. Division 23 (Mechanical) responsible for but not limited to:

1. All connections shall be made following local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.

3. Rough-in and final connection of mechanical systems to food service equipment, walk-in assemblies, and between components (including materials and labor).

4. A mechanical contractor will test and balance rooms and exhaust hoods. **Balance report for food service Exhaust Hoods to be provided to Foodservice Design Professionals (FDP) immediately upon completion (send to Houston.Submittal@fdp.org) and must be submitted with O&M manuals.**

5. Exhaust Hoods, Condensate Hoods, Fire Suppression Systems, connections, and controls (Provide and Install – unless otherwise specified). Provide tempered air at all supply ducts.

    a. If Exhaust/Condensate Hoods and Fire Suppression Systems are specified under Section 11 40 00, Division 23 is responsible for all Exhaust and Condensate Hood connections (Provide and Install).

6. VFD System and controllers when required by code (Provide and Install).

7. Provide and install all ventilation (direct or indirect), air conditioning, and heating systems (unless otherwise specified).

8. Coordinate Supply and Return ducts above Serving Counters. No cold air is to blow directly on hot food counters or open-air refrigerated merchandisers.

9. Coordinate Supply and Return ducts away from equipment with top-mounted refrigeration. No cold air is to blow directly on compressors.

10. Mechanical Contractor to locate temperature monitors within return ducts.

11. Circulating air above walk-in assemblies (Provide and Install).

12. Circulating air above and in air gaps at warehouse cold storage assemblies (Provide and Install).

13. Water Chillers as required (if equipment is provided in this project) (Provide, Size, and Locate).

14. Piping from Ice Builders to Tumble Chillers (if equipment is provided in this project) (Size, Provide and Install).

15. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

F. Division 26 (Electrical) responsible for but not limited to:

1. Rough-in and final connection of electrical systems to food service equipment, walk-in assemblies, and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 26.

2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.

3. Empty EMT Conduit with pull-wire and wide-sweep bends for interconnect cables between LAN and POS terminals, change-makers, pre-check units, printers, CPUs, etc. Division 26 to verify where the conduit will run for POS System (i.e., Manager’s Office or IDF Room).

4. Empty EMT Conduit with pull-wire and wide-sweep bends for fire suppression systems. Interconnect the Fire Protection System to panel box shunt trips and building alarm.

5. Walk-in Assembly Light Fixture Installation (Provided loose by Section 11 40 00) (if Walk-in is provided in this project).

6. Table Limit Switch (Provided loose by Section 11 40 00) (if Dishmachine is provided in this project) – Install and interconnect to Dishmachine.

7. Electrical Materials and Devices (Shunt-trip breakers, surge protectors, lighting control devices, conduit, wire, etc.).

8. Switches and Stainless Steel Disconnects as required (Provide, Locate, and Install – to be in an accessible location).

9. Charging Stations for Forklifts, Pallet Stackers, and Pallet Jacks (Size, Provide, Locate, and Install) (if equipment is provided in this project).

10. Interconnection between Condensate Fan and Dishmachine control panel (if equipment is provided in this project).

11. Interconnection between Exhaust Hood fans and switch (if equipment is provided in this project).

12. Interconnection between Exhaust Hood lights and switch (if equipment is provided in this project).

13. Door Heaters, Lights, Coils, and Heated Pressure Relief Ports pre-wired to the junction box at the top of walk-in assemblies (if equipment is provided in this project) provided by Section 11 40 00—final connection by Div. 26.

14. If any electrical accessories, fittings, and cord/plugs are provided loose with equipment by 11 40 00, Div. 26 is to attach to equipment and provide final connection.

15. Provide waterproof receptacles in wet areas.

16. All electrical connections beneath Exhaust Hoods (if equipment is provided in this project) to extend to shunt trip breakers with electrical panel box for shutdown during fire mode.

17. Receptacles will be pre-wired to Junction Box or Load Center for final connection by Division 26.

18. All electrical lighting, power, and distribution systems.

19. Do not interconnect more than three (3) convenience outlets on one (1) breaker.

20. Other than convenience outlets, all electrical connections on food service plans are dedicated breakers.

21. Doorbell at receiving door (Provide and Install –audible throughout Kitchen, Office, and Dry Storage room).

22. Adequate lighting at receiving door.

23. (if Walk-in is provided in this project) Walk-in Manufacturer is to provide Two (2) Edwards 860 Series (or equal) red lens, surface-mounted Xenon Emergency Strobe Beacons. Walk-in manufacturer will install One (1) located in the Kitchen above Walk-In Freezer door (or Cooler door when Freezer is within Cooler in an ‘inline’ assembly), and provide the second unit loose for installation by Division 26 located in the Cafetorium (Division 26 to coordinate location with Owners and Architect). Division 26 is to provide all conduit and wiring required and interconnect the illuminated Push Button

Panic Alarm in the Walk-In Freezer to both Strobe Beacons (***Critical***). Coordinate with Division 27.

24. Dedicated circuit for heated drain line connection in Walk-In Freezer (120/1/16.0 Amp) at each coil (if Walk-In is provided in this project).

25. GFCI Breaker for all receptacles under Exhaust Hoods (if Hoods are provided in this project) and Holding Cabinets (if Holding Cabinets are provided in this project), to be located within Kitchen's electrical Breaker Panel and not at the receptacles.

26. Remote GFCI reset switches to be accessible to end user.

27. All electrical below Exhaust Hoods (if Hoods are provided in the project) are to have Shunt Trip Breakers.

28. Interconnect Temp Sensor to Exhaust / Supply fans (if Hoods are provided in this project).

29. Electrical contractor to provide conduit with pulled wires prior to installation of equipment.

30. Refer to Section 2.5, ELECTRICAL REQUIREMENTS, for additional information.

G. Division 27 (Communication) responsible for but not limited to:

1. Data line coordination for food service equipment.

2. Time clocks as required.

3. Video cameras for learning assistance in food service areas as required (Provide, Locate, and Install).

4. (if Walk-in is provided in this project) (Provide conduit, data line, and interconnect the illuminated Push Button Panic Alarm inside the Walk-In Freezer to the Building Automation System (BAS). When activated, facility personnel are to be notified - coordinate notification requirements with the Owner (***Critical***). Coordinate with Division 26.

H. Division 28 (Electronic Safety and Security) is responsible for but not limited to:

1. Security Cameras as required (Provide, Locate, and Install).

I. General Contractor responsible for but not limited to:

1. Any wall penetration required for food service equipment utilities. Escutcheon plates or S/S sleeves are to be provided and installed as needed.

2. Bulk Freezer Ventilation Pipe (if Bulk Freezer is provided in this project) (Provide and Install unless otherwise specified).

3. Core drilling for Guide Rails (if Guide Rails are provided in this project).

4. Refrigeration Roof Curbs / Roof Jack (if Refrigeration System is provided in this project and located on the roof).

5. Interior Bollards (if required for this project) – to be epoxy painted per local codes (Provide and Install).

6. Furnish and Install ¾" Plywood blocking in the wall for mounting equipment furnished by Section 11 40 00 as required.

7. Walk-in Depressions (to be dead level) and sand leveling bed (if Walk-in is provided in this project and recess is shown).

8. Structural bracing for Bulk Walk-in Assembly ceiling panels if required.

9. Menu System Video Monitors in Servery (unless otherwise specified).

10. Structural bracing for Menu System Video Monitors if required.

11. Interior/Exterior refrigeration penetrations and sleeves at building penetrations.

12. DoorScope viewer (peephole) with wide viewing angle at receiving door.

13. Canopy at receiving door. Coordinate height with the height of Receiving Door (8') and the mounting height of Air Screen above the door.

14. Soap and towel dispenser provided by Owner. G.C. is responsible for installation.

15. Washer and Dryer (Provide and Install, unless otherwise specified).

16. Dwarf wall at exposed front/ends of cafeteria serving counters with the finish as selected by the Architect (if required in this project).

17. Substrate (Provide and Install) at SS Wall Caps for pony walls.

18. Final cleaning of all equipment before demonstrations.

1.5 QUALITY ASSURANCE

A. In addition to complying with all applicable laws, statutes, building codes, and regulations of public authorities, comply with the following:

1. National Sanitation Foundation (all equipment to bear label)

2. National Electric Code

3. Underwriters' Laboratories, Inc. (all applicable equipment to bear label)

4. American Gas Association Laboratories

5. National Fire Protection Association

6. Americans with Disabilities Act

7. Food and Drug Administration HAACP Guidelines

8. International Energy Conservation Code (IECC)

9. Department of Energy

10. Environmental Protection Agency

11. CSA Group

B. Furnish certification of regularly manufactured equipment listing or classification by Underwriters Laboratories, Inc., with the initial submittal.

C. Furnish a list of equipment and components (internal and external) that are not of domestic origin. All equipment and components (internal and external) should be of domestic origin when possible. This information should be provided with the initial submittal.

D. Projects outside the continental United States shall adhere to all local authorities having jurisdiction over that project.

1.6 SUBSTITUTIONS

A. **The specified equipment items or components are intended to be the basis of the bid. All other brands, including any additional names, which may be listed as "Alternates" or "Approved Equal," must conform with the general and item specifications, warranties, size/dimensions, quality, accessories, function, voltage, horsepower, etc. of the first-named brand and be subject to Paragraph C-03 of this Article.**

B. Proposed Substitutions:

1. Submitted at least 14 calendar days before Bid Date.

2. Submit proposed substitutions with catalog data and manufacturer's shop details indicating all modifications required to conform with the specified brand.

3. List of deviations must include equipment name, model number, accessories, and features with deviation(s) noted for specified and proposed alternate equipment. Equipment without listed deviation(s) will be considered furnished as specified.

C. Substitutions with prior approval:

1. Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.

2. Owner reserves the right to accept or reject any or all substitution proposals before execution of the Contract.

3. Provide all design/engineering services required to adjust in space, systems, utilities, etc., and pay all additional costs of utilities, construction, or professional services that may be incurred due to the acceptance of any substitution.

D. All appliances or other equipment within a common group or category (e.g., refrigerators, kettles, ovens, shelving, etc.) must be from the same manufacturer.

1.7 INTERPRETATION OF DOCUMENTS

A. During Bidding: Bidder's, supplier's, or vendor's questions and comments about Construction Document's clarity or intent will be addressed by addendum.

B. After Award:

1. Clarification Bulletin will confirm Construction Document requirements.

2. Request for Information submitted by Contractor shall contain Contractor's proposed resolution.

1.8 WARRANTY

A. Provide a written warranty for parts and labor for one year ***from the date of Substantial Completion***, including an extended four-year replacement warranty on compressor bodies.

B. Components of equipment subject to replacement before one year's use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.

C. Refrigeration Systems/Equipment: One-year free service available within twenty-four hours of notification.

D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number, and name of the person to contact. The service agencies selected shall be factory-authorized for the equipment assigned whenever possible.

E. Provide the following for refrigeration systems/equipment unless specified otherwise:

1. One (1) year of free refrigeration system service is available within twenty-four hours of notification.

2. Provide five (5) year manufacturer's registered written replacement warranty certificate covering compressor bodies. Warranty to cover labor costs for the first year.

3. Provide ten (10) years of the manufacturer's registered written replacement/repair warranty certificate covering walk-in assembly panels. Warranty to cover defects in material and workmanship. Warranty to cover labor costs for the first year.

4. Provide two (2) year parts and labor warranty for ***all parts/components (including third-party components that may be utilized)*** of the refrigeration system(s) ***(including freon)***, walk-in cooler(s), and freezer(s) not otherwise covered herein.

F. ***All above-stated warranty periods are from the date of Substantial Completion***. All replacement parts due to a warranty call should be the same quality as the original, or better if the original were defective. Replacement parts should be of domestic origin where possible.

1.9 SUBMITTAL DATA

A. **All submittals must be received, reviewed, and approved as noted prior to equipment procurement. If any equipment is procured prior to this process, it is on the KEC to replace any equipment, accessories, or other components that may not meet the specifications or design intent for the facility, including all costs associated with rectifying the errors made in procuring the equipment before this critical process.**

B. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.

C. Submittal Requirements:

1. Kitchen Equipment Contractor to furnish all submittals via PDF, drawings to be scaled per General Specifications and provided in Three (3) submittal packages.

2. Foodservice Design Professionals requires the below-listed business days for each package submitted. Packages are to be submitted within 14 days between each issued package. Each package should contain individual submittal sets.

a. Package One to include (2) Individual sets: 10 Business Days for Review

i. Equipment rough-in

ii. Equipment Brochure

b. Package Two to include (3) Individual sets: 10 Business Days for Review

i. Exhaust Hoods

ii. Walk-in Cold Storage Assemblies

iii. Refrigeration

c. Package Three to include (4) Individual sets: 15 Business Days for Review

i. Custom Fabrication

ii. Serving Counters

iii. Merchandising Equipment

iv. Miscellaneous Submittals

D. Submittals to be identified with the below-listed file name structure:

1. 11 40 00-1 EQUIPMENT BROCHURE
2. 11 40 00-2 EQUIPMENT ROUGH-IN PLANS
3. 11 40 00-3 CUSTOM FABRICATION
4. 11 40 00-4 SERVING COUNTER
5. 11 40 00-5 EXHAUST HOODS
6. 11 40 00-6 WALK-IN COLD STORAGE ASSEMBLY
7. 11 40 00-7 REFRIGERATION
8. 11 40 00-8 BEVERAGE MERCHANDISER

E. Package One (1) requires both submittals: Brochure and Rough-in plans. **If not sent together, the submittal will be rejected.**

F. Foodservice Design Professionals (FDP) will notate all submittals in RED. Architects and General contractors will be notated in color per their direction.

G. If hard copy submittals are required, Kitchen Equipment Contractor will furnish all copies to the specified trades as required.

H. If discrepancies, missing information, or incorrect information occur within the documents, Kitchen Equipment Contractor is to seek clarification or note the need for further direction on submittals. The Kitchen Equipment Contractor is to bid the higher of the discrepancies. *Refer to Section 1.3 SCOPE OF WORK: Subsection D.*

I. Brochure Format (for regularly manufactured equipment and components):

1. Front and rear protective cover with labeled project name.

2. Brochure index: Indicate Functional Area/Room number, item number, quantity, description, and manufacturer.

3. A separate flysheet for each component or item of equipment, indicating item number, name, quantity, manufacturer, optional equipment, modifications, special instructions, and utility requirements. Any equipment or assembly containing more than one buyout sub-assembly or component shall have the second item listed in parenthesis beside the primary item name—for example, Serving Counter (hot food well).

4. Catalog specification sheet with all options notated on the specification sheet and manufacturer's drawing.

J. Shop Drawings (Rough-In Drawings):

1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced). Submittal drawings are to be provided by Kitchen Equipment Contractor and not copied or reproduced from Contract Documents. Any reproduced submittal drawings will be rejected.

2. ¼" scale drawing of fixed/movable food service equipment and prefabricated Walk-in assemblies with itemized schedules.

3. Special Conditions Drawings, sizing, and locating the following conditions:

   a. Slab depressions, cores, sleeves, or block-outs (walk-in assemblies, drain trenches, piping, etc.).

   b. Concrete or masonry platforms.

   c. Pipe sleeves or roof jacks.

   d. Wall openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.

   e. Blocking grounds or anchor plates required in walls for equipment support/attachment.

   f. Above-ceiling hanger assemblies for support of exhaust hoods, ceiling-mounted pot racks, etc.

   g. Access panels in walls or ceiling for service of equipment.

   h. Ceiling pockets or recesses for unusually high equipment.

   i. In-wall carriers for wall-hung or cantilevered equipment.

4. Electrical Rough-In Drawing

5. Plumbing and Mechanical Rough-In Drawing

6. Required information:

   a. All fixed and portable food service equipment shown on Contract Drawings.

b. All prefabricated Walk-In Assemblies and Conveyor/Dishtable Assemblies shown on Contract Drawings.

c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices, not in this Section.

d. All Rough-In Drawings: Fully dimensioned from engineering benchmark (column lines, when provided) and finished-room surface to the point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical, and plumbing services.

e. Connection number/tag system and symbols: Identical to Contract Drawings.

K. Shop Drawings (Manufacturer's and Fabricator's):

1. Sheet Size: Identical to Contract Drawings, drawn or plotted at a ¼" scale for plan view, ½" for elevations, and 1½" for sections and construction details.

2. Included information: The item number, name, and quantity.

3. Construction details, sections, and elevations to reflect the requirements of the Specifications and Drawings.

4. Indicate adjacent walls, columns, and equipment.

5. Indicate plumbing and electrical schematic drawings for equipment such as conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems, and fabricated fixtures with a single electrical or plumbing connection.

6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment, or replacement of all moving parts.

L. All equipment and engineering rough-in plans sheet numbers are to match the contract documents. All equipment item numbers and engineer item numbers located on the schedules are to match the contract documents. All engineering requirements must be updated to accommodate the provided equipment and match the contract documents. The Kitchen Contractor coordinates any MEP revisions to accommodate the supplied and proposed equipment. The Kitchen Equipment Contractor is responsible for any costs associated with equipment substitution.

M. Foodservice Design Professionals (FDP) drawings and schedules are not to be copied in any way. Any replicated drawings of Foodservice Design Professionals (FDP) will be rejected.

1.10 SERVICE MANUAL

A. Three copies bound in 1½" hardback, three-ring binders (as many volumes as required by the scope of the project) with the same data as the brochure after installation (Refer to "Submittal Data"). Provide separate service manuals for each independent area within the project scope (Main Kitchen, Culinary, Concession, etc.).

B. Each Volume: Section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).

C. Catalog specification sheet and/or manufacturer's shop drawings, including wiring diagrams when applicable.

D. Each Volume: Index of items, manufacturer's operating/maintenance information, replacement parts data, list of all product warranties, and price lists. Provide the name, title, and address of personnel at each respective manufacturer and service personnel to be contacted for spare/replacement parts and service after the warranty period.

E. To the greatest extent possible, provide two copies of the manufacturer's instructional video cassettes for operating, maintenance, and equipment service.

F. Internally subdivide binder contents with permanent page dividers, logically organized by equipment item number or manufacturer name, with tab titling printed under reinforced, laminated plastic tabs.

G. Electronically submitted manuals must follow the formatting requirements listed above.

H. **Service Manual to be provided to the owner before kitchen equipment demonstration.**

1.11 VERIFICATION AND COORDINATION OF PROJECT / DATA

A. Utilities Rough-in Drawings and field verifications are to be completed within four weeks after receipt of notice-to-proceed. Review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors.

1. KEC to provide on-site field verification of all underground utilities before pouring concrete for capacity and location and coordinate with General Contractor. Submit a review to Architect and General Contractor. If rough-ins need to be relocated, KEC will compensate other trades for the required relocation.

2. KEC to provide on-site field verification of all other utility connections and locations and coordinate with General Contractor. Submit a review to Architect and General Contractor.

B. On-Site Inspection Reports

1. Before concrete pour: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

2. Before delivery of equipment: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

FOODSERVICE DESIGN PROFESSIONALS

0n - Site Inspection Report

Prior to Concrete Pour

Inspection Date_____ **Project Name** _____

Project Location_____

Inspector's Name_____ **Company** _____

Inspector's Contact Number_____ **Email** _____

Architectural Firm_____ **Project Architect** _____

Architect's Contact Number_____ **Email** _____

General Contractor_____ **Project Manager** _____

G.C. Contact Number_____ **Email** _____

Food Service Consultant Foodservice Design Professionals, LLC **Project Manager**_____

Contact Number 281.350.2323 **Email** _____

An on-site Inspection to verify the location of UNDERGROUND utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials _____

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

FOODSERVICE DESIGN PROFESSIONALS

CSA INSTALLATION APPROVAL REPORT

Report Date_____ **Project Name** _____

KEC Firm_____ **Phone Number**_____

Contact Name_____ **Email** _____

- ☐ **Walk-In panels are installed square, plumb, and level. Inspected prior to interior concrete pour.**
- ☐ **Ceiling panels are installed flush and tight to wall panels with undamaged gasket material. Any signs of condensation at joints or walls should be reported to FDP and addressed immediately. Caulk at panel seams will not be an acceptable solution.**
- ☐ **All cam-locks are engaged, and buttonholes are in place.**
- ☐ **Gaps under the screed or floor angle (due to shimming) are entirely sealed to the slab.**
- ☐ **Penetrations in the ceiling or wall panels are insulated and sealed.**
- ☐ **Weatherproofing / thermal barrier material is installed.**
- ☐ **All sharp edges of metal doors and diamond treadplate are clean of sharp edges and deburred.**
- ☐ **Door bumper or wall protection is installed and located as to prevent damage of door to adjacent walls.**
- ☐ **Cove base installed at all wall bases internal and external of walk-in.**
- ☐ **Door systems are correctly installed, and the door is self-closing and seals around the opening perimeter and at the floor threshold. Threshold has a smooth and level transition.**
- ☐ **Upon completion of the electrical connections, confirm the final operation of the IC/IC+ control, door heaters and light switches.**
- ☐ **Entrapment hardware and alarm systems are installed and functioning.**

KEC SIGNATURE_____

COMMENTS_____

_____

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

FOODSERVICE DESIGN PROFESSIONALS

0n - Site Inspection Report

Prior to Delivery of Equipment

Inspection Date_____ **Project Name** _____

Project Location_____

Inspector's Name_____ **Company** _____

Inspector's Contact Number_____ **Email** _____

Architectural Firm_____ **Project Architect** _____

Architect's Contact Number_____ **Email** _____

General Contractor_____ **Project Manager** _____

G.C. Contact Number_____ **Email** _____

Food Service Consultant Foodservice Design Professionals, LLC **Project Manager**_____

Contact Number 281.350.2323 **Email** _____

An on-site Inspection to verify the location of INSTALLED utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials _____

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

C. Review critical systems/components for application, performance, and capacity and submit calculation worksheets with the initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:

1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes, and locations.

2. Refrigeration Systems (compressor, condenser, and evaporator) capacities/sizes, quantities, and refrigerant piping distances/sizes.

3. Exhaust Hood Fire Suppression Systems (nozzle locations, air handler, fuel interlocks, piping/distance limitations).

4. Locations of Vacuum Breakers.

5. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, salad bars) with HACCP Guidelines.

6. Gas and water line sizes and manifold configurations.

7. Diameter and length of flexible connector lines for fixed/movable gas appliances.

8. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).

9. ADA compliance of workstations, service positions, passageways, etc.

D. Ceiling mounted appliances/fixtures: Verify and coordinate dimensions/location of support framing/hangers with the General Contractor—all material and installation below 12’-0” AFF: Section 11 40 00.

E. Dimension Responsibility: Obtain actual or guaranteed measurements for the proper equipment fit. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment and notify the Architect of all conflicts or deviations from the dimensions shown.

F. Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for their correctness. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect for instructions before proceeding.

G. Scheduling to Fit Openings: Should it become necessary to schedule the construction of walls or partitions before delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.

H. Refrigerated and Dry Storage Areas: Verify and coordinate dimensions to accommodate scheduled modular shelf sections. Notify Architect of the variance between the Contract Documents and actual conditions.

I. Color/Pattern Selections: Submit selection samples of solid polymer products, plastic laminate, paint or stain finishes, and vinyl-coated surface material of equipment as selected by the Owner.

J. Movable Equipment Interface: Rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at the time initial of shop drawing submittal. Indicate conflicts and proposed adjustments.

K. Relocation of Work: Relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.

L. **Kitchen Equipment Contractor must provide FDP with the food service equipment lump sum pricing (including material and labor) after the contract has been executed and *before submittals* are provided to FDP. *This information is critical to FDP for accounting/billing purposes.***

1.12 EQUIPMENT FURNISHED / INSTALLED BY OTHERS

A. Obtain and coordinate utility requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and rough-in drawings/provisions.

B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

1.13 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with the Owner at least ninety (90) days before equipment requirement.

B. Obtain and coordinate utility requirements of OF/CI equipment with the building utilities and rough-in drawings/provisions.

C. Receive at the job site and fully incorporate into installation procedures as if furnished under this Section.

PART 2 - PRODUCTS

2.1 FABRICATED FIXTURES MATERIAL / COMPONENTS

A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.

1. Stainless steel joints and seams: Heli-arc welded, free of pits and flaws, ground smooth, and polished to a No. 4 finish.

2. The “grain” direction of horizontal stainless-steel surfaces: Longitudinal, including the backsplash. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.

B. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.

1. Galvanized iron joints and seams: Arc-welded, free of pits, flaws, and ground smooth.

2. Galvanized sheets or shapes: Washed with mineral spirits and painted with Rust-Oleum gray semi-gloss enamel.

C. Sound Deadening: Schnee Butyl Sealant ½" wide rope positioned continuously between all frame members or contact material and underside of stainless-steel surface (sinks, tabletops, food wells, over shelves, and undershelves). Tighten stud bolts for maximum compression of sealant and trim excess.

D. Plastic Laminates: Color/pattern selected by Architect, in 1/16" thickness for flat surfaces: 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be NSF-approved (Standard No. 35).

E. Solid Polymer products: Color/pattern/material selected by Architect in thickness as specified. Solid Polymers and adhesives must be N.S.F. approved (Standard No. 51).

F. Casters:

1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Verti-Lock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.

G. Cutting Boards: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated.

H. Identification Plates, Labels, Tags:

1. Prohibited Information: Names of suppliers, fabricators, and contractors.

2. NSF Labels: Required on all pieces of equipment.

3. Required Information: Function or purpose of controls such as display light switches, food warmer controls, etc.

4. Plate Construction: Engraved phenolic plastic, secured to equipment with epoxy cement or stainless-steel screws. Furnish samples.

2.2 PLUMBING / MECHANICAL REQUIREMENTS

A. Plumbing Fittings and Components: Furnished under this Section as follows:

Note: Fitting and components described in Items 1, 2, 3, 4, and 5 are furnished loose by 11 40 00 for final installation and connection by Division 22.

1. Control valves and appliance pressure regulators for water, gas, steam, and vacuum breakers: wherever required on food service equipment (chrome-plated where exposed).

2. Faucets and drains with and without connected overflows (unless otherwise indicated) for all sinks.

3. Specialty food service water-fill faucets, hose bibbs, or hose assemblies indicated in drawings/specifications.

4. Wade Model No. W-10 Shock-Stop shock absorbers for all food service equipment with quick-opening or solenoid-operated water valves.

5. Dormont Series Water Quick Disconnect hose, diameter per water connection size requirements, with safety fitting, w/coiled restraining device, full port ball valve, antimicrobial coating, lifetime warranty.

6. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food-holding components of serving counters (e.g., cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: All drains to be type 'K' Copper – Paint with aluminum paint where exposed**. Div. 22 to ensure a minimum air gap of 1" and not less than twice the effective opening of the indirect waste pipe, per code. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.**

7. Piping brackets and supports beneath fabricated equipment.

8. Closed Base Bodies: Removable 18-gauge stainless steel closure panel at plumbing penetrations under the top.

9. Control valves on Open Base fixtures: Mounted on a 14-gauge stainless steel gusset-shaped panel with h 3½" setback from the countertop edge/rim to the face of the control handle.

10. Fill hose/faucet at support pedestals or Closed Base Body: Installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60° angle, with 3/8" stainless steel rod hanger-bracket for the hose.

11. Provide filtration option as shown on contract documents (a, b, c, or combination thereof):

    a. In-line Water Filter System:

        i. Everpure System filters for coffee/tea brewers, icemakers, water chillers, convection steamers, and beverage systems. They should be sized per the manufacturer's recommendation.

    b. Remote Central Water Filter System.

    c. Remote and/or In-line Reverse Osmosis system.

B. Gas-Heated Equipment Fittings and Components: Furnished under this Section as follows:

1. Fixed Equipment: Dormont 1675KIT2S48 gas appliance connector: Diameter per fuel volume/connection size requirements. Gas valve diameter size per fuel volume/connection size requirements.

    a. Restraining device: Heavy duty steel cable, fastened to equipment and walls, 3" to 6" shorter than equipment connector length.

C. Final Plumbing Connections Provisions:

1. Fabricated equipment containing components, fittings, and devices indicated on food service connection drawings to be connected to the building systems: each component,

fitting, or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.

2. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, convection ovens, etc.): plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.

3. All plumbing final connection points of equipment shall be tagged, indicating the following:

   a. Item number

   b. Name of devices or components

   c. Type of utility (water, gas, steam, drain, chilled water)

D. Ducts and Vents:

1. Exhaust hoods furred-in to ceiling: 2” high duct collar for final connection to the duct system.

2. Warewash machines equipped with integral vent cowls or extended hoods: furnished with 18-gauge stainless steel seamless duct risers to 6” above the finished ceiling for final connection. The duct: trimmed at the ceiling with a 16-gauge stainless steel angle flange with all corners welded.

E. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Sub Sections E. Plumbing and F. Mechanical for additional information.

2.3 FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS

A. Install complete with all refrigerants, oil, dials, dehydrators, gauges, and controls required for the system’s proper operation.

B. Self-contained or factory-installed compressors: Check and adjust to the proper operating temperature prescribed by FDA/HACCP.

2.4 PLUMBING TRIM

A. Faucets: Furnished for all sinks or equipment requiring open water supply.

B. Fill Faucets: Furnished for appliances requiring open water supply.

C. Drain Fittings: Furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless-steel fittings in die-stamped openings with washers and locknuts. The solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

2.5 ELECTRICAL REQUIREMENTS

A. All electrical systems, components, and accessories within the work of this Section: Certified to be in accordance with NEC 70.

B. Electrical Fittings and Components: Furnished under this Section as follows. Coordinate food service equipment loads, voltage, and phase with the building system and confirm any existing or OF/OI equipment requirements.

C. Cord and Caps:

1. Coordinate all food service equipment cord/caps with related receptacles.

2. All 120, 120/208, and 208 volts “plug-in” equipment shall have Type SO or SJO cord and plug with ground wire fastened to the frame/body of the item.

3. Cord lengths for fixed equipment: Adjusted to eliminate loose-hanging excess.

4. All non-fixed plug-in “buy-out” equipment: Hubbell configuration and ratings as required.

5. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8’-0” cord length with cord-hanger strap secured to the rear of equipment or mobile stand.

D. Switches and Controls:

1. Each motor-driven appliance or electrically heated unit: Equipped with a control switch or starter per Underwriters’ Laboratories, Inc., with low-voltage and overload protection.

2. Disposer controls recess-mounted in the wall: External fittings and accessories removed from the enclosure and furnished with 12-gauge stainless steel perimeter angle flange with welded corners. Install control at 4’-0” AFF to the bottom of the enclosure.

3. Disposer controls recess-mounted in counter-splash risers: External fittings and accessories removed from NEMA 4 enclosure and furnished with 12-gauge stainless steel perimeter angle flange with welded corners. Install control at 3’-0” AFF to the bottom of the enclosure. Provide the panel with a 60” long Seal-Tite electrical conduit from the bottom of the control panel for final field connections under Division 26.

4. Equipment that is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.

5. All remote manual starters, disconnect switches, magnetic contactors or starters, and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.

E. Heating Elements:

1. Electrically heated equipment: Thermostatic controls.

2. Water heating equipment: Equipped with positive low water shut-off.

F. Receptacles and Switches:

1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12” x 8½” x 3” deep recessed mounting panel sloped at a 60° angle and turned up to the top of the opening.

2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6” from the bottom of utility or compressor compartments.

3. Receptacles mounted on Open Base fixtures: Installed on a 12” x 10½” x 4½” deep 14-gauge stainless steel panel with returned ends and sloping recess—secure panel to the underframe of fixture top.

4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on the underside of the lower shelf. Vertical runs of wiring: Made in rigid conduit or within the tubular leg.

5. Receptacles installed in/on-fabricated equipment: Hubbell, Inc. assemblies horizontally mounted in a metal box with stainless steel cover plate.

6. Switches installed in/on-fabricated equipment: Hubbell, Inc. with metal box and stainless-steel cover plate. Switches: pre-wired to the controlled device and a junction box installed within 6” from the bottom of the utility or compressor compartment. All refrigeration system switches: Installed within the compressor compartment near the door opening.

7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to the load center with balanced phase loading. Load center: Ready for final connection by Division 26 and flush-mounted within the utility compartment rear panel, set back 8” from the access door. All breaker/device information will be typewritten on the circuit schedule in the load center door (number corresponding breaker/device) with an enclosed schematic wiring diagram of fixture components.

8. All receptacles are to be pre-wired to the cord and plug assembly and routed through the over-shelf post at all island equipment locations unless specified otherwise.

G. Light Fixtures:

1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).

2. LED Display Light: Install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.

3. Heat Lamps: Installed to the underside of serving shelf assemblies. When multiple 24” heat lamps are specified, provide maximum length heat lamp chassis. Install all switches remotely from lamps.

4. **Walk-in assembly LED Light Fixtures: Furnished by Section 11 40 00, final installation by Div. 26. All electrical wiring and conduit, provided by Div. 26, electrically connected through the Vapor Proof light fixture base connection, located on the interior door header—all Conduit to be Seal-tight conduit. Door frame wiring stubs out the top of panels 8” in flexible conduit for final connection by the electrical contractor. All horizontal conduits: below ceiling panels. All lighting fixtures will be wired from inside the assembly—no penetrations through**

the ceiling panels. Seal-sleeved penetrations are airtight at both sides of the panel. KEC is responsible for verifying that trade contractors seal all penetrations.

H. Final Electrical Connection Provisions:

1. Fabricated equipment containing electrically operated components or fittings indicated on Utility Connections Drawings: Direct connected, with each component, fitting, or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.

2. Fabricated equipment containing electrically operated components and devices indicated: Circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.

3. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connection Drawings by Division 26.

4. Pre-wire the following groups of walk-in assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).

   a. Light fixtures and switches; heated pressure-relief ports.

   b. Door/jamb heaters.

   c. Evaporator fans, defrost elements and drain line heaters.

5. All electrical final connection points of equipment shall be tagged, indicating the following:

   a. Item number.

   b. Name of devices on the circuit.

   c. Total electrical load.

   d. Voltage and phase.

I. Lamps: in all food service equipment containing light fixtures. Refrigerator or heated cabinets: All exposed LED lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.

J. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection F. Division 26 (Electrical) for additional information.

2.6 CUSTOM – FABRICATED / ASSEMBLED UNITS

A. Mechanical or electrical operating components or products integrated into a fabricated fixture: Ventilation and service access required or recommended by the manufacturer. The size and

placement of the service access panel(s) permit easy lubrication, adjustment, or replacement of all moving parts and are to be indicated on fabrication shop drawings.

2.7 BAKER TABLETOPS (Unless specified otherwise)

A. 14-gauge 304 S/S top with 2" square turn down at the front, 6" high enclosed splash at two (2) sides and rear. Brace same as "Counter/Tabletops."

B. 1¼" x 6" high integral coved riser at rear and ends unless indicated otherwise on drawings.

C. 16-gauge stainless steel flour-trough at free long sides, secured to the underside of the top. Trough: 3" diameter with eased edges/corners.

2.8 COUNTER / TABLETOPS

A. 14-gauge stainless steel; all free edges turned down 2" with ¾" tight hem at the bottom—free corners: rounded on ¾" radius.

B. Marine edges: Turned up ½" on 45º angle and turned down 2" with ¾" tight hem at the bottom.

C. Cafeteria serving countertops at hot food stations: Full-length x 3½" x ½" high raised rail at (customer's) front side with 45º integral turndown to counter surface.

D. Tops abutting high fixtures or walls: Cove up specified height and slope back 1½" at the top on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of the splash and tight ends to the bottom of the top turndown. Secure splash turndown to the wall with a 4" long 14-gauge stainless steel "Z" clip anchored to the wall, 36" OC.

E. Freestanding tables and all serving counter splash-risers: Turned back at a 90º angle with 1" turndown at the rear.

F. Brace tops with rigid-welded 1½" x 1½" x 1/8" galvanized steel angle frame at the perimeter with cross bracing 2'-0" OC maximum. Provide 4" x 4" x 12-gauge stainless steel triangular pads where leg gusset welds to frame. Paint the entire frame with Rust-Oleum gray semi-gloss enamel. Angle frames: Secured to the underside of top surfaces with ¼" studs welded 9" OC maximum with chrome-plated washer, lock washer, and cap nut. Studs: Such length that cap nuts can be made up tight, bringing the top down snugly on the angle frame, eliminating all vibrations or "oil-canning."

G. Tops: 1½" overhang at free sides of underframe or Closed Base Body.

H. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly or integrally welded stainless-steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground, and polished to match the top. When conditions permit, provide a 1" x 1½" rectangular backsplash opening for service utilities instead of piercing the horizontal surface. Install stainless steel split tubing at the raw edge of the opening.

I. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.

J. All openings in tops: 3/16" high raised die-formed edges.

K. All top openings for pans or inserts: 20-gauge stainless steel, watertight liners, 8½" deep, secured to the underside of the countertop.

L. All “built-in” and “drop-in” counter equipment/appliances to have framing members at the perimeter of the opening.

M. Scrap Basket: 18-gauge stainless steel construction 6½” x 6½” x 21¾” long. Top of container: 5/8” wide x ¼” high full perimeter flange with ¼” diameter stainless steel rod bail handle. Interior vertical corners coved on ½” radius. Countertop: Fitted with 6¾” square die-stamped opening.

2.9 COLD PANS

A. 14-gauge stainless steel with ¾” coved interior welded integrally to the countertop with a 3/16” raised edge at the perimeter of the opening – depth of cold pan to follow NSF 7 compliance.

B. Slope bottom to required quantity of Component Hardware Model No. E16-4021 drain fittings at 48” OC maximum. Sleeve through insulation at drain fittings and extend common drain line into utility compartment for indirect waste connection.

C. ½” OD copper refrigerant lines in a serpentine pattern, 1½” OC flattened for maximum contact. Secure tubing to the underside of ¼” thick aluminum “distribution plate” installed tight to the underside of the frost plate area and apply cold-conductive mastic to all surfaces.

D. Component Hardware Model No. E16-4021 drain fittings at 48” OC maximum, sleeved through the insulation with common drain line extended into utility compartment.

E. Heat Cable: Low-wattage, full-perimeter, below countertop at the edge of depression. Secure with “Z” clips, 9” OC, and interwire with compressor switch for simultaneous operation.

F. Enclose the sides and bottom of pans with an airtight 18-gauge galvanized jacket and pack with 2” fiberglass insulation set in mastic.

G. Compressor: Size as indicated or required to accommodate the size of the cold pan. Locate the compressor in the compartment below the unit or as shown on the drawings.

H. Sectional 16-gauge stainless steel perforated false bottom (¼” holes, @ ¾” OC). Turn down 1½” on all sides, weld corners, and provide finger rings. False bottom sections: 24” long maximum.

2.10 DRAWERS

A. Stainless Steel Liners: Component Hardware Model No. S81-2020C (20” x 20”), easily removable with drawer in the fully extended position.

B. Drawer Frame: 16-gauge stainless steel flanged out at the top. Weld the frame to a double-panel 16-gauge stainless steel drawer front with full-length recessed pull at the top (similar profile as Garcy Model No. R-1060) with closed ends.

C. Channel-formed horizontal pull: ¾” turndown at the front and ends with ½” tight hem. The front edge of the pull: flush with the face of the drawer. Recess behind pull: sloped up on a 60° angle, terminating 1” below the bottom edge of pull.

D. Mount drawer frame on Component Hardware Model No. S52-2020 self-closing slides, with Delrin bearings, full-depth of the fixture. Secure slides to the body or brackets to eliminate lateral movement in the extended position. Refrigerator drawers: Component Hardware Model No. S52-2024 stainless steel slides with Delrin bearings.

E. Drawer enclosure in an Open Base Fixture: 18-gauge stainless steel flanged out at the top for attachment to the underside of the tabletop. The lower edge of the enclosure is flanged in toward the open bottom. Mount drawer slides to enclosure and brace as required. The face of the enclosure is to be the same length and height of the drawer face. Provide ¾" deep offset in front of the enclosure and 2½" from the underside of the tabletop for a flush-fitting appearance.

F. Drawer enclosure on freestanding fixture: Full depth of table framing.

G. Drawer enclosure in a Closed Base Fixture: Completely partitioned from the adjoining area. Drawer front: Flush fitting with the face of the body.

H. Drawer Liners other than tool/utility: **Bread Drawer:** S/S liner sized to fit drawer; **Refrigerated Drawer:** S/S liner sized to fit drawer.

I. Cash Drawer: Integral stainless-steel body, 3" deep.

2.11 FOOD WELLS (UNLESS SPECIFIED OTHERWISE)

A. Food Warmer Controls: Remote-mounted in sloping recessed apron panel. The control panel is recessed 2½" from the bodyline at the top of the 60° slope and 1" at the lower edge. Terminate slope angle 2½" below the countertop. Mount panel on concealed piano hinge at bottom edge; secure with screws at upper corners.

B. Manifold all warmer drains and extend to within the utility compartment for indirect waste connection. Install valve in the drain line and extend handle through compartment door.

C. Removable 18-gauge stainless steel closure panel at the underside of warmers.

D. 14-gauge stainless steel plate/utensil shelf full-length of hot food station unless noted otherwise: 10" below countertop x 9" deep, with rear panel coved up to the underside of the countertop; end panels turned up square. Front of shelf: Turned down 1½" and returned under for closure panel attachment.

E. Food wells: Hatco Model No. HWBIBRT-FULD insulated food warmer (1200 watts, 208 volts, single phase) secured to the underside of 12" x 20" die-stamped countertop openings with thermal breaker mastic rope applied at the perimeter of food well flange.

F. Soup Warmers: Hatco Model No. HWB-11QTD soup warmer secured to the underside of 11" diameter die stamped countertop opening with thermal breaker mastic rope applied at the perimeter of soup well flange. The maximum allowable temperature of the countertop at the contact surface is: 120°F. Each warmer: Equipped with one 11-quart stainless steel round insert and slotted cover.

2.12 SINKS

A. 14-gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius. 1½" wide double-walled partitions with flat tops between compartments.

B. Continuous exterior panels of multiple-compartment sinks: 14-gauge stainless steel filler panel welded ground and polished between compartments.

C. Sinks (with overflow): Score and slope sink bottom ½" to die-stamped opening fitted with Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. 18-gauge stainless steel bracket: Welded to sink bottom for drain stem with 1½" handle clearance.

D. Where sinks are installed in fixtures with Closed Base Body, provide a Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. (Sinks with dimensions larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 18-gauge stainless steel bracket: welded to sink bottom with T & S Model No. BL-4740-1 guide bushing. Install on shortened drain stem, one T & S Model No. BL-4710-1 remote control stem assembly only (length as required) with Model No. 113-L universal joint and white blank button. Set drain control handle in Cambro Model PSB-6 bowl with bottom omitted (dress raw edge) to permit passage of drain handle—secure bowl in utility compartment door or body panel with clear silicone.

E. When single-hole deck-mounted faucets are specified, install overflow fitting in the sidewall of the sink compartment and provide ell-fitting in connecting tubing.

F. Flush Covers when specified: 1/2" thick Read Products, Inc. "Richlite" cutting board with two (2) finger holes, size as indicated. Support clips: ¼" stainless steel rod 2" long, formed at 45º with two ¾" leg ends (¼" long threaded ends). Insert rod clips through tight-clearance holes in the sink, seal watertight, and secure with stainless steel acorn nuts or tack-weld at the exterior of the sink wall. Set support clips ½" below the top. Provide a 14-gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: Adjacent to sink compartment, below countertop, or under drawer assembly.

2.13 TRAY SLIDES (UNLESS OTHERWISE SPECIFIED)

A. Tray slides: 12" wide, solid 14-gauge stainless steel turned up 2" at the rear behind countertop turndown; turned down 4" at the front and free ends unless otherwise indicated.

B. Three ¼" high die-formed inverted "V" ridges at 4" OC, 2" from the leading edge, terminating 2" from ends of tray slide with tapered ridge ends.

C. Ridges formed on radius: Equal-length segments with 2" separation between chords.

D. Secure tray slides to countertop/body frame, same as "Countertops." Enclose the exposed underside of the tray slide with 18-gauge stainless steel.

E. When indicated, project tray slides 2" beyond the serving countertop and return the entire width of the serving counter at free ends.

F. All tray slides are to be provided and mounted per ADA requirements.

2.14 DISHTABLES

A. Soiled/clean dishtable: 14-gauge stainless steel; free edges coved up 3" with 1½" diameter rolled rim and bullnose corners.

B. Edge of dishtables next to high fixtures or walls: Coved up 10" and sloped back 1½" on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of splash and secure to wall with 4" long 14-gauge stainless steel "Z" clips anchored to the wall, @ 36" OC.

C. Exposed rear splash: 16-gauge stainless steel finish panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end. Secure the panel with concealed attachment and install bracing 24" OC.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot to sinks, scuppers, or ware wash machines, maintaining level crown/splash.

E. Brace dishtables with 1" x 4" 12-gauge stainless steel channels down the top centerline and between each pair of legs, with closed ends. Bracing: secured to the underside of the dishtable with ¼" studs welded 6" OC maximum, with chrome-plated washer, lock washer, and cap nut. Studs: such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."

F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops; ground and polished to match the top.

G. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

H. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.

I. Paper-Drop Opening: 9" square with 4" integral chute having hemmed bottom edge. Slope dishtable top 1" toward the opening, forming a 16" square tapered deposit point.

J. Accessible Tray-Drop Opening: 10" x 18" with integral 16-gauge stainless steel seamless chute sloped at 45º angle toward the center of mobile soak sink position.

K. All dishtables with a Conveyor Type Dishmachine must have a table limit switch provided by Manufacturer and installed by Division 26. Prepare clean dishtable with holes for table limit switch and provide s/s back cover. Wiring must be concealed within dishtable fabrication.

2.15 UTENSIL – WASH COUNTERS

A. 14-gauge stainless steel; all free edges coved up 3" with 1½" diameter rolled rim and bullnose corners.

B. Edges of utensil-wash counters next to high fixtures or walls: Coved up 10" and sloped back 1½" on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of splash and secure backsplash to the wall with 4" long 14-gauge stainless steel "Z" clip anchored to wall @ 36" OC. Vacuum breaker pockets: 4" long square turnback sections aligned with the slope break line.

C. Exposed Rear Splash: 16-gauge stainless steel finished panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end of the splash and ½" turnback at the bottom of the panel. Secure the panel with concealed attachment and install bracing 24" OC.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot, maintaining level crown.

E. Brace utensil-wash counters with 1" x 4" 12-gauge stainless steel channels down the centerline of the top and between each pair of legs, with closed ends. Bracing: Secured to

underside of dishtable with ¼" studs welded 6" OC. maximum, with a chrome-plated washer, lock washer, and cap nut. Studs: Such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."

F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops: ground and polished to match the top.

G. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on a leg/bracket assembly.

H. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

2.16 DOORS

A. 18-gauge x 1" stainless steel double pan-formed welded construction, insulated with 1" thick polyurethane boards. Seal the perimeter joint of the pans. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the Body.

B. Channel-formed full-length horizontal recessed pull: ¾" turndown at the front and ends with ½" tight hem. The front edge of the pull: Flush with the face of the door. Recess behind pull: Sloped up on a 60° angle and terminated 1" below the bottom edge of pull.

C. Door Hardware

1. Two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge location).

2. Component Hardware Model No. 35-2000 Concealed Magnetic Catch.

3. Component Hardware Model No. D30-4780 lock in the upper free corner of the door.

D. Louvered opening: Cut out opening size as indicated, turn in 1", and weld. All corners: Ground and polished.

1. Full-height 18-gauge stainless steel louver with 1" vanes at 45º, ½" spacing. Perimeter channel-formed frame: 1½" x 1".

2. 45º x 1" x ½" x opening width plus ½" 18-gauge stainless steel louver.

3. Tack the louver flange's weld tab to the door's back panel.

E. Drain handles opening: 6" diameter hole through the double pan to accommodate Cambro Model No. PSB-6 Bowl:

1. Secure the bowl to the door panel with clear silicone.

2. Omit the bottom of the bowl. Dress raw edges of opening for passage of drain handle.

3. Exposed insulation at the penetration of the door pan: Painted black.

F. Sliding Doors: fabricate same as Paragraph "A."

1. Aluminum Sliding Door Track: Component Hardware Model No. B57-0000 Series, length as required. Secure to angle frame at the top of the underside.

2. Front/rear door sheaves: Stainless steel ¾" side-mounted door hangers; two (2) required per door.

3. Recessed Vertical Pull at Upper Corner of Door: Component Hardware Model No. P63-1012.

4. By-Passing Door Guides secured to bottom shelf: Component Hardware Model No. B62-1093.

5. Door Stop at the bottom edge of door: Component Hardware Model No. B60-1086.

G. Offset the lower horizontal framing member of the Closed Base Body/utility compressor compartment to align the door flush with the bottom of the Body.

2.17 CLOSED BASE BODIES

A. Frame: Rigid-welded 1½" x 1½" x 1/8" galvanized steel angle forming a continuous structure around the top and bottom perimeters of the fixture, a post at each corner, studs spaced 48" OC maximum. The top of the frame is cross-braced with 1½" angles, 2'-0" OC maximum.

B. 18-gauge stainless steel panels and trim with concealed attachment. All seams: Welded, ground, and polished.

C. Exposed Vertical Corners: Rounded on ¾" radius. Closed Base Bodies adjacent to walls or fixtures: square corners.

D. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: Closed and sealed.

E. Closed Base Bodies set on finished masonry platforms: closed and caulked at the underside of equipment overhang and bolted to the platform. Body overhang of the platform: 1" at free ends and 2" at the front and exposed rear sides.

F. Closed Base Bodies not set on the platform: Component Hardware Model No. A54-2-6, 6" legs spaced 4'-0" OC maximum.

2.18 COMPRESSOR COMPARTMENTS

A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.

B. 10-gauge steel slide-out support: Channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on the solid platform: front-to-back slide-out support channels set 4" above the bottom for air circulation.

C. Access Door: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full length of the top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turndown at front and face of the door. Recess behind pull slopes up on a 60° angle, terminating 1" below the bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.

D. Access Doors Louver: Full-height, with 1½" x 1" x 18-gauge stainless steel channel-formed frame with welded corners. 18-gauge stainless steel louver. Submit a sample of the design for approval.

2.19 UTILITY COMPARTMENTS

A. Closed Base Bodies or Pedestal Supports: Fitted with utility compartments wherever piping or wiring is required in/on the fixture.

B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.

C. Access Doors: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full-length of the top (similar profile to Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turn down at the front of the door, a recess behind the pull slopes up on a 60° angle, terminating 1" below the bottom edge of the pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of the door with the face and bottom edge of the body. Door hardware: two (2) Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.

D. No shelves of Closed Base Fixtures are to be penetrated.

2.20 UTENSIL RACKS

A. Rack: ¼" x 2" 300 series stainless steel flat bar with No. 4 finish, fully welded and formed to match the shape shown on drawings. Lowest band - 7'-6" AFF unless otherwise indicated.

B. Ceiling Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing from band to 18" above the ceiling. Anti-sway bracing above the ceiling - 1½" Unistrut members. Tubing penetrations at the ceiling - Component Hardware Model No. A16-0206 stainless steel gussets.

C. Table Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing extended through countertop. Secure to closed base framing or cross rail/undershelf on the open base fixture. Tubing penetrations of countertops - integrally welded stainless steel inverted gusset.

D. Utensil Rack Hooks - Component Hardware Model No. J77-4401 stainless steel hooks spaced 8" OC maximum.

E. Electrical Receptacle: NEMA No. 5-20-R or as noted. Mount in fully welded 3½" x 5½" x 3" 14-gauge stainless steel enclosure with ½" radius corners. Stainless steel cover plate to fit specified receptacle. Pre-wire through tubular support for final connection above the ceiling by Division 26.

2.21 CASHIER / SERVING COUNTERS

A. Exterior Body Panels, when specified: ¾" thick marine grade hardwood plywood with plastic laminate or solid polymer in Architect's selection of color/pattern at all exposed surfaces; backing sheet where concealed.

B. Position, size, and finish horizontal or vertical reveal as Architect directs.

C. Secure panels to counter body framing in a concealed manner. Install removable panels with “Z” clips overlapping body framing members.

D. Hinged doors in exterior body panel(s) - Grass Model No. 1200VZ or 1200VZ8 self-closing hinges. Three (3) required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM820 concealed push latch at each door. Confirm Model No. and provide samples with the submittal.

E. Cashier counter to have 16-gauge s/s intermediate shelf, turned down 1 1/2” with tight hem at front. Cove up 2” at rear and sides. Brace undershelf with 1” x 4” 14-gauge stainless steel channel at the longitudinal centerline. Provide an outlet for power/data within the body above the intermediate shelf. Provide cash drawer inserts per district standards.

F. Sneeze Guards to be adjustable and meet NSF standards.

2.22 OPEN BASE STRUCTURES

A. 1-5/8” OD x 16-gauge seamless stainless-steel tubing legs bevelled at the bottom. 1¼” OD cross rails fully welded (360° smooth and polished) to legs at 10” AFF, OC.

B. Top of Leg: Inserted in Component Hardware Model No. A20-0206 gusset fully welded to table frame or sink bottom.

C. Bullet Foot: Component Hardware Model No. A10-0851.

D. Freestanding fixtures requiring utility connections: Component Hardware Model No. A10-0854 flanged feet at the fixture corners, anchored to the floor with non-corrosive bolts.

E. Table Bases: Maximum leg spacing of 6’-0” OC; dishtable and utensil wash counter bases at 5’-0” OC.

F. Open Base equipment specified to be supported by brackets at the rear side only (not completely cantilevered): Tubular legs at the front side only with Component Hardware Model No. A10-0854 flanged feet anchored to the floor with non-corrosive bolts. Front-to-back cross rail: fitted into Component Hardware Model No. A20-0406 circular gusset secured to the wall with non-corrosive bolts.

2.23 UNDER SHELVES

A. Open Base Structures: 16-gauge stainless steel turned down 1½” with tight hem at the bottom. Notch all corners to fit tubular legs and weld from the underside to fill the gap, grind, and polish. Cove up 2” at the rear or ends adjacent to wall, columns, refrigerators, etc. The turn-up at freestanding fixtures is to be hemmed tight to the bottom of the turndown. Brace undershelf with 1” x 4” 14-gauge stainless steel channel at the longitudinal centerline and each intermediate pair of legs.

B. Open Base Structure specified to be supported by brackets at the rear side only (not completely cantilevered): 16-gauge stainless steel turned down 1 ½” at free sides with tight hem at the bottom edge. Notch all corners to fit tubular legs as required and weld from the underside to fill the gap, grind, and polish. Cove up 2” at rear ends, as indicated. Fill the gap at the front-to-back rail, grind, and polish. Brace undershelf with 1” x 4” x 1” 14-gauge stainless steel channel at longitudinal centerline between front to back rails.

C. Closed Base Fixtures: 16-gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: Turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.

1. Shelves: Turn up square at ends (coved up at rear only) to the shelf above or countertop flanged out for attachment with no open spaces at interior.

2. All shelf partitions at exposed ends of cabinet bodies or interiors: Free of exposed framing members.

3. Reinforce shelves with full-length 1" x 4" x 14-gauge stainless steel closed hat channel.

4. Unless otherwise noted, all closed base undershelves must be 22" deep and clear.

5. Fully weld smooth and polish the vertical seam of the shelf turndown/turn up with the face of the body partition.

6. Seal the vertical seam of the square turn-in at the exposed interior of open shelf sections.

2.24 ANCHOR PLATES / WOOD GROUNDS

A. Behind the finished surface, wherever building walls, partitions, or ceiling construction will not accommodate direct attachment of equipment such as over shelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 11 40 00.

B. Anchor Plates: Not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.

C. Wood Grounds: Length required by fixture, component, or device, 24" wide x ¾" thick plywood secured to partition system before gypsum board installation.

D. Above ceiling supports: Structural shapes (4" x 8.0 lb. channel) suspended from the structure. Maximum height 15'-0" AFF. Size: width of equipment x length of equipment plus 6'-0". Cross bracing at 6'-0" OC maximum.

2.25 OVER SHELVES

A. 16-gauge stainless steel with free edges turned down 1" with ½" tight hem at the bottom—¾" radius at free corners.

B. Turn up 2" raw at walls and sides with a horizontal coved corner at the rear. Round front corners of turn up on ¾" radius.

C. Where shelf width exceeds 12" width, reinforce with ½" x 4" x 14-gauge stainless steel closed hat channel full-length of the shelf.

D. Wall-Mounted Shelves: 16-gauge stainless steel brackets 48" OC maximum, set in 6" from ends.

E. Freestanding Shelves: Where splash is required at free over shelves, turn up square 2" at ends, cove up at the rear, and hem tight to lower edge of front turndown. Weld exposed corners.

1. Freestanding over shelves: 16-gauge stainless steel cantilevered brackets at the rear of the table; double-cantilevered brackets at the center of the table. Posts for cantilevered over shelves are 1-5/8" OD x 16-gauge stainless steel secured to the underframe, 4'-0" OC. Ends of shelves: Secured to adjacent wall/fixture or mounted on 1¼" diameter stainless steel posts.

2. Freestanding over shelves not on cantilevered brackets: 1¼" OD x 16-gauge stainless steel posts, each pair at 4'-0" OC maximum.

F. Baker Table Over shelves: Supported 18" above the top with 1¼" OD stainless steel tubular supports with channel shoe secured to risers.

G. Glass/Cup Rack Over shelf at Dishtables: 14-gauge stainless steel with 1½" deep "vee" trough at free long sides with 1" tight hem inside the trough. Provide a ½" marine edge at free ends and; a 4" splash at the wall. Suspend shelf at 18" above dishtable surface on posts/brackets anchored to dishtable frame/wall at rear; 1" OD stainless steel tubing supports from the structure above the ceiling at front edge, 60" OC at each end.

1. Install at both ends a ½" stainless steel drain tube (connecting both vee-troughs) extended to the dishtable surface through splash turnback.

2. Rack-rest: horizontal full-length 1-5/8" OD stainless steel tubing supported at 10" OC above shelf (8" OC for double service shelf) by 1¼" OD stainless steel tubing with closed ends. Support tubing: welded, ground, and polished, spaced 60" OC.

3. Rack-rest supports to wall: 4" x 4" x 10-gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

2.26 DRAIN TRENCH LINER / GRATING

A. Liners: 14-gauge stainless steel in sizes as indicated.

B. Interior of liners: 6" deep with all interior corners (horizontal/vertical) coved on ¾" radius; sloped and scored 1" to integrally welded Component Hardware Model No. D34-Y011 basket drain assemblies @ 48" OC, fitted with 6" long welded tailpiece. Stainless steel safety chain: connected to basket strainer assembly and top of liner wall.

C. Liners: 1" wide perimeter shoulder at the top, turned up flush with finished floor, tight hemmed back down to the shoulder level, and flanged out 2" for attachment to the slab.

D. Underside of sloping liner portion: 2" long "Z" clips.

E. Grating: IMC-TEDDY PFD-ADA removable fiberglass grating:

1. 1" deep "I" bearing bars with 0.6" wide top flange.

2. Full perimeter frame, section quantities, and sizes indicated.

3. Maximum of 2'-0" sections.

4. Grating bars should be spaced 0.4" apart per ADA requirements.

5. Grating to be two (2) equal sizes.

2.27 WALL PANELS

A. Wall Panels: 18-gauge stainless steel, double pan-formed ½" thick with internal stiffener members. Fill with USDA-approved thermal insulation, full height, and width of panels, and attach to the interior with mastic. The maximum allowable temperature at the rear side of the panel: is 120°F.

1. Height of panels as required: Top of tile base to the underside of the hood, top of tile base to the top cap of stub wall, or top of splash to the underside of the hood.

2. Level and square lower edge and sides.

3. Butt joints on all panels.

2.28 EXHAUST HOODS (UNLESS SPECIFIED OTHERWISE)

A. Exhaust to be provided to meet all current local jurisdiction mechanical and energy code requirements. Kitchen Equipment Contractor to verify code requirements and coordinate with Divisions 23 and 26. Hoods over production equipment to be Type 1 with continuous capture. All Type 1 hoods should be 6' deep to ensure smoke/steam capture unless otherwise noted.

B. Install fire suppression system(s) in all ventilators specified in this section. Install per the manufacturer's recommendations and applicable codes or standards. Submit installation certification form to Architect.

C. Locate chemical cylinders as indicated on drawings and install piping to exhaust hood(s) in a concealed manner. Set cylinders and cabinets at 7'-0" clear AFF unless noted otherwise. Provide polished chrome plated tubing piping/fittings, where exposed at cylinder location and at the interior of exhaust ventilator—exposed pipe threads in/above the food zone are not allowed. Submit a schematic installation diagram and confirm critical distances from cylinders to nozzles.

D. Remote manual release located in the path of egress from the protected exhaust hood area. Kitchen Equipment Contractor to coordinate location with local Fire Marshal requirements before submittal review. All conduits will be recessed within the wall; SURFACE MOUNTING WILL NOT BE ACCEPTED.

E. Provide one (1) handheld Type 'K' and ABC 6-liter fire extinguisher per Ansul system, surface wall mounted.

F. Required quantity and sizes of mechanically operated gas valves.

G. Confirm interconnection of all equipment as required to ensure exhaust hood and fire suppression systems are entirely operational and meet local jurisdiction code requirements.

H. ½" diameter steel hanger rods at 4'-0" OC maximum to be by Kitchen Equipment Contractor, but they are to be anchored to the supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.

I. Provide an appropriate quantity of fire suppression systems as required by local jurisdiction code requirements.

J. Double wall insulated construction at ends. S/S where exposed.

K. Hoods and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements.

L. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection E. Division 23 (Mechanical) for additional information.

2.29 HIGHLIGHTING

A. Polish the following vertical surfaces to a No. 8 finish:

1. Serving and display shelf turndowns.

2. Conveyor and dish/tray deposit station turndowns/frame.

3. Tray slide turndowns.

2.30 SHOP / FIELD JOINTS

A. Field joints: The least number is used only when equipment size must be limited for building or interior space access.

B. Stainless steel tops (including edges and splashes): Fully welded, ground, and polished to match adjacent surfaces.

C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of the field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw joints: located and noted on shop drawings.

D. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to the back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide a flat backing surface for a joint with the angle of other joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" OC.

E. Closed Base Bodies: Draw-type with hairline seam fully field-welded.

F. Millwork: Plastic laminated joints shall be dowelled, glued, and draw-bolted with fasteners.

G. Solid Polymer: Surfaces drawn tight, filled, sanded, and finished to match adjacent surfaces.

2.31 PREFABRICATED WALK-IN COLD STORAGE ASSEMBLIES

A. Assembly to be installed by Factory Authorized Installers only.

B. KEC to provide a 1-year walk-in assembly panel installation warranty. Panel installation warranty to cover labor and part replacement issues resulting from a failure to complete the following during installation:

1. Walk-in assembly panels to be installed square, plumb, and level.

2. To create a proper seal, ceiling panels must be installed flush and tight to wall panels with undamaged gasket material. Any signs of condensation at joints or assembly wall

panels should be reported to FDP and addressed immediately. Caulk at panel seams will not be an acceptable solution.

3. All cam-locks should be engaged and cam-lock covers in place.

4. Any gaps under the floor angle (due to shimming) must be entirely sealed to the slab.

5. All penetrations in the ceiling or wall panels should be insulated and sealed by appropriate trade contractors and verified by KEC, including but not limited to Light Fixtures, Refrigeration Lines, Sprinklers, Temperature Sensors, etc.

6. Proper installation of the door systems should allow the door to self-close and seal around the perimeter of the door opening and at the floor threshold.

7. Final operation of the IC/IC+ control, door heaters, and light switches should be confirmed upon completion of the electrical connections.

8. The walk-in assembly panel installation warranty will cover service issues resulting from faulty installation.

C. **KEC is responsible for overall install accuracy/quality and quality control of work performed, regardless of the installer or any field modifications due to building/construction conditions. KEC is to provide the CSA Installation Approval Report (provided in this document) to Foodservice Design Professionals (FDP) upon completed installation, verifying that all items above have been inspected by the KEC for completeness and installed per manufacturer requirements. This report will be required as part of the completion of the contract.**

D. Sectional Assemblies: Size/shape indicated on drawings; 9'-6" interior clearance unless otherwise specified. Door locations/size: exactly as shown.

E. Sandwich Panel Insulation: Class 1 Urethane with a vapor barrier, 4" thickness (unless specified otherwise) with mature "U" factor of .030 or lower. Finished panels shall be UL-listed and demonstrate a flame spread rating of 20 or less. Panels must meet performance standards as outlined in U.S. Government legislation.

F. Wherever compartment dimension exceeds the clear-span ability of ceiling panels, provide I-beam support on the exterior of the ceiling or spline-hangers. Install ½" diameter steel rods through beams/hangers and secure them to the structure above. Beams or posts within compartments are not acceptable.

G. Reinforce prefabricated wall panels to rigidly support the door assemblies. The perimeter of the door and frame shall be built of a fiberglass reinforced polymer (FRP) pultrusion. All pultrusion's shall be non-conductive, non-corrosive, rust proof and NSF listed. All doors shall be furnished with a replaceable aluminum braided heater wire, electronically monitored, and controlled as to initiation temperature, termination temperature and percentage of operation time as required. Install 2" x 4" 16-gauge stainless steel hat-channel full-width of the jamb with 1/8" stainless steel removable flush sill, secured with stainless steel screws and sealed watertight to channel.

H. Reinforcement as required to be provided above Freezer door (exterior) and panel next to door (handle side – interior) for mounting of Emergency Strobe Beacon, Push Button Panic Alarm and Release Knob. Emergency Strobe Beacons are by Division 26.

I. Provide an aluminum cove base at the interior and exterior of exposed panels for all floor assemblies.

J. Floor Installations:

1. **8-1/2" Recessed Floor Installation (if required):**

   a. Factory floor in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.

   b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.

   c. 4" manufacturer's floor.

   d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.

   e. 1/2" sand leveling bed by G.C.

   f. Concrete flooring and tile over insulation by Divisions 03/09.

2. **Surface Mounted Factory Floor Installation (if required):**

   a. 4" commercial grade manufacturer's dura floor with diamond treadplate surface and marine grade plywood subfloor.

   b. 36" reinforced diamond treadplate internal ramp.

   c. 10-gauge stainless steel threshold to provide a smooth transition to the interior walk-in assembly floor.

K. Modularm Model No. 75LC (Unless otherwise specified). Integrated, flush-mounted temperature monitor/alarm with sensor and probe-cord length required to extend from the exterior front of the assembly to a mounting position of the sensor within the evaporator return airstream. System to have an easy-to-read LCD with high and low alarm set points with audible and visual alerts for alarm conditions. System to include Adaptive Programming for automatic set point control. Wi-Fi connectivity is included for remote notifications of alarms such as power failure, high and low temperatures, entrapment, and door open. System to include a built-in panic alarm. The system is to be interconnected to the Building Automation System (BAS) or the Owner's Network (by Division 27) and to notify facility personnel of the district/owner choosing when activated.

L. Modularm Model No. IP-1 (unless otherwise specified). Heated Illuminated Push Button Panic Alarm with protective cover and Phenolic Label "PANIC ALARM" for entrapment **within Freezer** (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm to panel above Freezer door (or Cooler door if 'inline' assembly) for installation of Emergency Strobe/Horn. Division 26 will provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium in location as directed by Architect). Division 27 will interconnect the Push Button Panic Alarm to the Building Automation System for Owner notification. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsections F. Division 26 (**Electrical**) and G. Division 27 (**Communication**) for additional information.

M. KE2 Smart Access (unless otherwise specified). Confirm all component model numbers for complete installation and operation.

N. LED surface-mounted light fixture, in quantity/arrangement shown on drawings. Light fixtures to be perpendicular to coils. Light fixtures wired to interior and exterior temperature control panel. Light fixtures are to be provided by Section 11 40 00 and installed by Division 26. Division 26 is to seal all conduit penetrations at light fixtures. KEC to verify that penetrations are sealed.

O. Penetrations of Panels: To be sealed by factory installer and appropriate trade contractors, with Dow Corning 3-6548 silicone RTV foam, total depth of the panel. Trim excess flush. KEC to verify that all penetrations are sealed.

P. Install closure panels and trim strips to building walls and ceiling with concealed attachment. Closure material: same as wall panels unless noted otherwise.

Q. Compartment Entrance Doors: 36” x 78” nominal clearance unless otherwise noted.

1. Mount hinged doors on two Kason Model No. 1346; polished chrome-plated nylon cam-lift hinges. All doors to be equipped with polished chrome Kason 1094 or equivalent door closer assembly. Doors to be adjusted so all doors fully self-close.

2. Hinge doors as indicated on drawings.

3. Defrost heater: Thermostatically controlled and replaceable at the entire perimeter of all doors. Defrost heaters to be wired for continuous service.

4. 36” high x full-length diamond aluminum treadplate at front and rear of all hinged doors.

5. 12” x 2” engraved phenolic plastic compartment identification sign in Architect’s color selection with 1” letters, mounted above door window.

6. 14” x 24” four-panel glass view window with heater and molded non-metallic inner and outer frame. The heater is to be wired and controlled via the door monitor for continuous service.

7. Padlock/key provisions in the door latch with safety release mechanisms.

8. Kason 1826 Intelli-Vent LED Heated Pressure Relief Ports with Dual Port Vent and Security Light. Locate Two (2) 12” below ceiling on Cooler/Freezer common wall panel and Two (2) 12” below ceiling on Cooler wall panel. If Cooler and Freezer are separate units, locate one on the Freezer wall panel as well, 12” below ceiling and mounted in the door frame assembly. All ports to have separate dedicated electrical connections and be wired for continuous service. Located and installed by Manufacturer.

9. Kason Model No. 1238CQ (unless specified otherwise) Pacesetter Locking Handle QTLC polished chrome with Kason 0485 glow-in-the-dark backplate and turn knob safety release.

10. Manual backup vacuum release mechanism to punch 6” diameter hole in ceiling panel to release vacuum within freezer assembly. Mechanism to include a pull-down handle with freeze-proof hand grip. Handle to have the ability to penetrate and/or punch hole in wall accordingly to assist with opening of door assembly in the event of entrapment (and failure of inside release knob). Release mechanism assembly to be built-in/mounted to panel structural frame to minimize

mechanism tear-out and/or failure. Handle to be glow-in-dark yellow with phenolic label “Vacuum Pressure Release.” Punch out portion to be replaceable in opening without the use of tools or sealants. Punch out is not to be located directly over interior ramp.

11. Provide Two (2) Edwards 860 Series (or equal) red lens, surface-mounted Xenon Emergency Strobe Beacons. Walk-in manufacturer will install One (1) located in the Kitchen above Walk-In Freezer door (or Cooler door when Freezer is within Cooler in an ‘inline’ assembly) and provide the second unit loose for installation by Division 26 located in the Cafetorium (Division 26 to coordinate location with Owners and Architect). Division 26 is to provide all conduit and wiring required and interconnect the illuminated Push Button Panic Alarm in the Walk-In Freezer to both Strobe Beacons (***Critical***).

R. Provide refrigeration calculations and refrigeration alarm to meet local jurisdiction code requirements.

S. If air screens or air shields are specified above doors or on the interior of the assembly, the manufacturer must provide adequate blocking in panels to support these components and pre-wired electrical connections. Installer to coordinate location of door closure to not interfere with air screens or air shields. Clear-VU, swinging door assemblies, are not required if air shields are specified.

T. S/S trim above walk-in assembly to conceal manufacturer ceiling grid.

U. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment.

V. Walk-in Assemblies to be installed by the PRE-APPROVED INSTALLERS listed below:

1. QBR Refrigeration, 30083 Hwy 90 Blvd., Katy, TX 77493, Mr. Andy Spellins, 713-973-2875, andy.spellins@qbrsales.com

2. Machine Ice, 8915 Sweetwater Ln., Houston, TX 77037, Mr. Will Weaver, 281-448-7823

3. Coolers Inc., 6922 Alder Dr., Houston, TX 77081, Mr. Lee Mamone, 713-665-8886

2.32 WALK-IN COLD STORAGE ASSEMBLY REFRIGERATION SYSTEMS

A. Unit Coolers: specified quantity and model, ceiling-hung by ½” OD nylon bolts with stainless steel washers and nuts. Insert hanger bolts through the plastic sleeve and seal penetration airtight.

1. Unit cooler drain fittings: positioned as indicated on drawings. Installation of cast tee-fittings on drain pan outlet with union and cleanout plug and extension of 1” Type K copper drain line through wall panel to airgap fitting or floor drain under this Section.

2. Slope drain line ½” per foot, trap at the exterior of assembly and turn down into the drain. Manifold drain lines of adjacent compartments wherever possible.

3. Install drain line plastic sleeve through compartment wall, seal around drain line, and install stainless steel escutcheon with setscrews.

4. Electric drain line heater cable (self-regulating 7 watts): on all unit coolers operating below 36°F., installed from coil drain line fitting to wall penetration under this Section.

Heater cables: the minimum rating of 15 watts/lineal foot, 208 volts, single phase. Wrap drain line with maximum 2" loop spacing and interwire to unit cooler for continuous operation.

5. Mounted, pre-piped, and pre-wired evaporator components:

   a. Sporlan thermostatic expansion valve with external equalizer.

   b. Shut-off valve at evaporator suction and liquid lines.

   c. Sporlan "Catch-All" refrigerant filter/dehydrator on liquid line.

   d. White Rogers 1609-101 adjustable thermostat with remote bulb positioned in return airstream of the evaporator.

   e. Electrical disconnect switch in NEMA 4 enclosure.

   f. **For any facility within 20 miles of a salt air environment:** Condenser and Evaporators to be built with Electrofin coating to retard salt air deterioration. Coils are to be coated with Technicoat 10-2 coating for protection against a salt air environment.

   g. 110° Ambient Temperature Operation.

6. Two (2) fan door activation switches to turn off evaporator coils when the door is opened.

B. Refrigerant System Installation:

1. Refrigerant Lines; Type "L" rigid copper tubing. Fittings: Wrought copper or brass designed for use with high-temperature solder. Piping joints: Made with silver solder (Sil-Fos). Piping: Properly suspended from and anchored to the structure with adjustable hangers 6' OC maximum. Suction lines: Sized to have a maximum pressure drop of two pounds in medium-temperature systems; one pound in low-temperature systems. Liquid lines: Sized to give maximum pressure to prevent trapping of oil. Insulation on all suction lines: Armaflex insulation by Armstrong. ¾" thick at medium-temp 1" thick at low temp. Refrigerant lines in PVC conduit: Sealed at both ends with Dow Corning 3-6548 silicone RTV foam. The refrigeration system installer will wrap Exterior Refrigerant Lines in the self-fastening jacket of Type 3003-H14 aluminum alloy 0.016-inch thick. Provide aluminum strapping and seals for applying aluminum jackets and covers according to the manufacturer's recommendations for a completely weather-tight covering.

C. Evacuation and Charging:

1. After completion of the pressure test, the system shall be evacuated using an approved auxiliary vacuum pump. Connections for evacuation: Following the manufacturer's recommendations.

2. Charging after the initial charge, which is contained in the condensing unit (R448A Non-CFC Ozone Depletion Refrigerant for medium and high temp units, R513A - Non- CFC Ozone Depletion Refrigerant on low temp units) – (Refrigerant must meet District Standards, Industry Standards, and local Codes): given through the charging valve in the high side passing all of the liquid refrigerants through a charging dehydrator. All charging lines and gauges must be purged of air before connection with the system.

Refrigerant: unused and shall be delivered in clean containers. After the system is fully charged: start and place it in full operation.

D. Refrigeration system to be installed by the **PRE-APPROVED INSTALLERS** listed below:

1. QBR Refrigeration, Mr. Andy Spellins 30083 Hwy 90 Blvd., Katy, TX 77493, 713.973.2875, andy.spellins@qbrsales.com

2. Machine Ice, Mr. Will Weaver, 8915 Sweetwater Ln., Houston, TX 77037, 281.448.7823

3. Coolers Inc., 6922 Alder Dr, Houston, TX 77081, Mr. Lee Mamone, (713) 665-8886

2.33 PRE-APPROVED KITCHEN EQUIPMENT CONTRACTORS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid.

B. **Any contractor requesting inclusion within this bid must submit AIA form 305 a minimum of 14 days before the bid date for review or as required by Architect.**

1. Stafford Smith, Mr. JP Garcia, 7129 North Loop East, Houston, TX 77028, Phone: 713.892.5001, Email: jpgarcia@staffordsmith.com

2. Texas Metal Equipment Company, Mr. Travis Andrews, 23518 Coons Road, Tomball, Texas 77375, Phone: 713.466.8722, Email: tandrews@tmeco.com

3. Kirby Restaurant Supply, Mr. Brian Kernan, 809 S. Eastman Road, Longview, Texas 75602, Phone: 903.757.2723, Email: briank@kirbysupply.com

4. Mission Restaurant Supply, Mr. Robert Snoddy, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 832.970.4020, Email: roberts@missionrs.com

5. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 409.769.1199, Email: terry@kommercialkitchens.com

6. Supreme Fixtures Co., Inc., Mr. Tim Hampel, 11900 Vinny Ridge Road, P.O. Box 193655, Little Rock, AR 72219, Phone: 501.455.2552, Email: tim@supremefixture.com

7. Amundsen Commercial Kitchens, Mr. Lewis Beville, 105 Montie, Longview, TX 75604, Phone: 903.576.6354, E-mail: lewis@afeok.com

2.34 PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid. Pre-approved fabricators shown below shall not sub-out fabrication.

B. **Any supplier requesting inclusion within this bid must submit AIA form 305 at least 14 days before the bid date for review or as required by Architect.**

1. Texas Metal Equipment Company, Mr. Travis Andrews, 23518 Coons Road, Tomball, Texas 77375, Phone: 713.466.8722, Email: tandrews@tmeco.com

2. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 832.767.5287, Email: terry@kommercialkitchens.com

3. Mission Restaurant Supply, Mr. Robert Snoddy, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 832.970.4020, Email: roberts@missionrs.com

4. CSS Manufacturing, Mr. Jared Woodard, 7430 Fairbanks North Houston Rd., Houston, Texas 77040, Phone: 832.444.6311, Email: jared.woodard@css-mfg.com

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Supervision: Provide a skilled and proficient foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: Coordinate with the progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:

1. Field-assembled fixed equipment integrated into the structure (e.g., walk-in assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks) are to be sent to the job site when directed by the General Contractor and installed or protected accordingly.

2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor, wall systems (including painting), and painted gas lines.

3. Major Movable Equipment: delivered, when possible, to inventory in a secured area for interim job-site storage or, if the secured area is unavailable when fixed equipment installation/clean-up has been completed.

4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) should be delivered only when the Owner is prepared to receive and inventory such items.

C. Installation: performed by the manufacturer of custom fabricated fixtures.

1. Assemble, square, level, and ready all items for the final utility connections.

2. Cut neatly around obstructions to provide sanitary conditions.

3. Where gaps of ¼" or less occur adjacent to or between equipment, insert rope backing and smoothly apply General Electric construction sealant Series SE-1200 silicone mastic (clear color). Mask both sides of the gap for neat sealant application and remove excess. If space exceeds ¼," neatly install 18-gauge stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement or "Z" clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.

4. Refrigeration coil drain line runs to an indirect drain connection greater than 2" from the face of the wall or panel: Either of the following field procedures:

a. Trench the floor and provide a 6" wide x 2" deep 16-gauge stainless steel sloping (-1" to -2") trough from the face of the cooler/freezer wall to the body of the floor sink/floor drain. Trough: turned up 4" at the wall; ¾" flange with ½" turndown at

both long sides. Set trough in waterproof mastic and seal 1" OD drain tube penetration into floor sink/floor drain at -2½" BFF. Patch the floor to match adjacent material/surface.

b. Provide 12" x 6" x 2" deep 16-gauge stainless steel condensate pan mounted to cooler/freezer wall at 6" AFF clear. Trench the floor and install a 1" OD drain line from the bottom of the pan to the body of the floor sink/drain. Slope drain line ¼" per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:

1. Fabricated fixtures: Fiberboard or plywood taped to tops and exposed body panels/components.

2. Manufactured Equipment: Fiberboard or plywood taped as required by equipment shape and installation-access requirements.

3. Prohibited use of equipment: Tool and materials storage, workbench, scaffold, stacking area, etc.

4. Damaged Equipment: Immediately documented and submitted to the Owner with the Contractor's recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

A. Clean up and remove all debris from this Work from the job site as the installation progresses.

B. Lubricate and adjust drawer slides, hinges, and casters.

C. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.

D. Clean or replace faucet aerators and line strainers.

E. Touch-up damage to painted finishes.

F. Start up and check the operation of all refrigeration systems for at least 72 hours before acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

A. Carefully test, adjust, and regulate all equipment following the manufacturer's instructions and certify in writing to the Owner that the installation, adjustments, and performance are in full compliance.

B. Provide the Owner or food service Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected equipment items and attendees with the Owner at least two weeks before the demonstration starts.

3.4 FINAL OBSERVATION

A. Final observation will be made when the Contractor certifies that they have completed their work, thoroughly reviewed the installation/operation of each item in the contract and found it to comply with the Construction Documents.

B. Repetitive final observations (more than two) and all costs associated with it which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a $70.00/hr and expense basis.

PART 4 - EQUIPMENT SCHEDULE

4.1 REGULARLY MANUFACTURED EQUIPMENT/COMPONENTS: Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT: Arrangement and configuration as shown on Plans, Elevations, Detail Drawings, and outlined in Specifications.

4.3 REFER TO DRAWINGS: For unit quantities and plumbing, electrical or mechanical provisions are required, including the manufacturer's optional voltages, wattages, burner capacities, etc.

4.4 REFER TO PART 2 – PRODUCTS: For accessories, fittings, requirements, and procedures related to the listed buy-out and fabricated equipment.

4.5 ALTERNATE MANUFACTURER REQUIREMENTS: A specific product manufactured by the listed pre-approved equals shown under Section 4.7 Food Service Equipment are acceptable only if the specific product can evidence compliance with the specified line items and the contract documents (Refer to Section 1.6; Sub-Section A.).

4.6 RE-USED EXISTING EQUIPMENT IF PROVIDED IN THIS PROJECT

A. Existing equipment scheduled for re-use is to be inventoried and documented that equipment is in operating condition once Kitchen Contractor has taken ownership.

B. Provide pictures of all equipment once inventoried and issue them to the architect to ensure that equipment has not been damaged.

C. Verify the locations of all equipment with the owner.

D. Existing equipment that is to be reused may need parts or accessories for proper and complete operation. Submit a report listing all items with pricing for approval to allow complete installation.

E. Utility disconnection and re-connection: Under Divisions 22 and 26. Kitchen Contractor to verify utility requirements of existing equipment and coordinate with Foodservice Design Professionals (FDP) as required. If utilities shown on FDP drawings do not match the requirements of existing equipment – KEC is to relay that to FDP immediately. All utilities not scheduled for re-use must be capped and covered by required disciplines.

F. Disassembly, removal, transportation, and relocation: under this Section and scheduled with General Contractor. The owner's representative must be present and coordinate the date/time with the owner.

G. Thoroughly clean inside and out before relocation.

H. Review functional parts (e.g., doors, controls, heating elements, compressors, etc.) and submit a report of required repairs and cost estimates. Any finishes or equipment damaged due to construction will be repaired as required.

I. Existing equipment not scheduled for reuse is to be carefully removed/relocated by the Kitchen Contractor per the Owner's direction. Kitchen Contractor to coordinate the date/time with General Contractor and Owner.

J. Removal or replacement of existing equipment is to be scheduled for times of least interruption and inconvenience to the food service operation. Submit the proposed time frame schedule, task sequence, and process for approval before starting work.

K. Kitchen Contractor to verify size and shape for all existing re-used equipment and coordinate with Foodservice Design Professionals (FDP) as required.

L. Any modification(s) required/desired for re-used existing equipment to be verified by the Kitchen Contractor. Before the changes are made, all modifications must be approved by the Owner and Foodservice Design Professionals (FDP).

M. The KEC is to verify and coordinate all the utility requirements with the construction documents as required. Refer to the general specifications regarding conflicts.

4.7 FOOD SERVICE EQUIPMENT

A. All equipment is to have a performance check from factory-authorized personnel. Warranties will begin on the day of the performance check.

B. All equipment and internal components should be of domestic origin where possible.

C. Architect to verify/coordinate the aesthetic options below (Food Service color, material, or signage selections) if these items are provided in this project:

1. Countertops: Stone (stainless steel is provided unless otherwise specified)

2. Tray slides: Corian or Stone (stainless steel is provided unless otherwise specified)

3. Counter fronts: Ceramic tile, 3 Form, or Plastic Laminate

4. Sneeze Guards: Stone insets

5. General color, material and graphic selections:

    a. Display Air Screen Merchandisers – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)

    b. Bakery Display Cases – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)

    c. Pass Thru or Reach-In Holding Cabinets - Color selection: Powder Coat (Mfg.: True) or Plastic Laminate (Mfg.: Traulsen) (Stainless steel is provided unless otherwise specified)

    d. Hanging Heat Lamps – Track and Fixture color selection

    e. Heated Merchandisers

f. Portable Guide Rails – Stanchion and Belt color selection

g. Popcorn machine – Signage selection

h. Bottle Cooler – Signage selection

i. Graphics Package information

j. Hot Food Well covers

D. Architect to verify/coordinate the finishes below:

1. Walls: Ceramic Tile, Flat FRP, or Molded FRP (Smooth, Impervious, and easily cleanable as approved by local jurisdiction)

2. Ceilings: Removable Vinyl Face Tile (Smooth, impervious, and easily cleanable as approved by local jurisdiction)

3. Floors: Tile, Epoxy, or Rubberized flooring system (Smooth, impervious, easily cleanable and slip resistant as approved by local jurisdiction) (Coordinate floor tile transition at serving lines)

4. Floors: Walk-in Assembly – Extend kitchen floor flush into Walk-in assembly with coved base

5. Furr Downs above Serving Counters

FOODSERVICE EQUIPMENT

ITEM NO. 101 AIR SCREEN

QUANTITY 1

Manufacturer:	Mars
Model:	STD248-1UA-OB standard ext.
Size and Shape:	Refer to drawings
Alternate:	Berner

1. Air curtain, STD2 series model, unheated, obsidian black exterior. Size unit to fit door.
2. Air Curtain to include Model #J0023 Controller Kit. Controller kit to come complete with plastic magnetic reed switch, surface mounted, .50 HP max, 115v/1-ph limit switch. The magnet to be mounted on the surface of the door jamb and the door.
3. Confirm clearance above door prior to installation. Air Curtain to accommodate door width and height.
4. 114000 to provide magnetic reed switch kit loose to General Contractor for installation by Division 26. Division 26 to route flexible conduit to j-box on cabinet. Routing to be clean and secured to building.
5. Provide Harsh Weather Cover if no awning or recessed door is provided.

ITEM NO. 102 COLD STORAGE ASSEMBLY

QUANTITY 1

Manufacturer:	American Panell
Model:	---
Size and Shape:	Refer to drawings
Alternate:	Thermokool

1. Installation to be completed by Factory Approved / Authorized installer. Refer to Section 2.33 Submittal drawings to include factory approval letter or certificate.
2. Manufacturer to review final installation and provide a letter confirming installation meets manufacturer requirements.
3. Assembly to have 9'-6” interior clearance.
4. 304 #3 finish 20 gauge stainless steel finish where exposed, 26 gauge Acrylume where concealed.
5. Factory floor with smooth aluminum finish, recessed in slab 8 1/2". Secure floor to wall assembly with cam-lock assembly. KEC to ensure the floor assembly is level prior to the wearing bed installation. Kitchens finished floor to extend to walk-in.
6. Threshold to be smooth and level with finished floor. **-** Critical.
7. Interior walls to be .040” aluminum, white embossed texture on walls.
8. Ceiling to be embossed textured .040” aluminum baked white enamel.
9. Two (2) 36" doors. Doors to be 18-gauge stainless steel, type 304 (18-8), #3 finish, with heated perimeter / door jambs / windows and threshold heaters. Each door to be equipped with 3'-0" high diamond tread kick plate on both sides of doors. Mount hinged doors on two (2) Kason model no. 1346 (or equal); polished chrome plated nylon cam-lift hinges. Proper installation of the door systems should allow for the door to self-close and seal around the perimeter of the door opening and at the floor threshold.

10. Provide heated illuminated Push Button Panic Alarm with protective cover and Phenolic Label “PANIC ALARM” for entrapment within Freezer (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm to panel above Freezer door (or Cooler door if ‘inline’ assembly) for installation of Emergency Strobe/Horn. Division 26 will provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium). Division 27 will interconnect the Push Button Panic Alarm to the Building Automation System for Owner notification.
11. The Cooler will have the standard control panel with standard panic button tied into the Owner's network for notification.
12. Provide Kason model no. 0487 Frost Free Inside release (or equal) for each cold storage door assembly. Fiberglass rod and plastic flange, with safety glow plastic knob, ADA compliant.
13. Manual backup vacuum release mechanism to punch hole in wall assembly to release vacuum within freezer assembly. Mechanism to include a pull-down handle with freeze-proof hand grip. Handle to have the ability to penetrate and/or punch hole in wall accordingly to assist with opening of door assembly in the event of entrapment (and failure of Frost free inside release button). Wall panel to include a knockout section to assist with requirements. Release mechanism assembly to be built-in/mounted to the door assembly structural frame to minimize mechanism tear-out and/or failure. Handle to be painted yellow with phenolic label “Vacuum Pressure Release”.
14. 20-gauge stainless steel, type 304 (18-8), #3 finish trim where adjacent to walls and enclosure panels that extend to 2" above finished ceiling.
15. Freezer One (1) lot LED light fixtures to operate in temperatures to -20 F. Lights to be installed perpendicular to coils.
16. Refrigerator- One (1) lot LED light fixtures. Lights to be installed perpendicular to coils.
17. 3’-0” high diamond tread plate at exposed exterior surfaces. Fasten to wall with stainless steel fasteners.
18. Provide door bumper at doors.
19. Compartments to have all electrical concealed within the walls or located above the ceiling.
20. Provide Manufacturers alarm/control system that includes hi/low limits. Route temperature sensor to be located to the side of evaporator coil.
21. Doors to be provided with CCI Industries, Inc., Clear-VU swinging door assemblies, Alternate: Kason.
22. All holes in assembly to be sealed by factory installer.
23. Kason 1826 Intelli-Vent LED Heated Pressure Relief Ports with Dual Port Vent and Security Light. Locate One (1) 12” below ceiling on cooler/freezer common wall panel and One (1) 12” below ceiling on exterior cooler wall. All ports to have separate dedicated electrical circuits. Pressure relief ports to be wired for continuous service. Relief port to be located and installed by Walk-in Manufacturer.
24. KEC to field verify all horizontal/vertical measurements and conditions at the building prior to fabrication or delivery of equipment.
25. KEC to provide 1-year walk-in panel installation warranty. KEC is responsible for overall install accuracy/quality and quality control of work performed regardless of installer or any field modifications due to building/construction conditions. KEC to provide Letter of Install Approval to FDP upon completed install.
26. Manufacturer to provide One Year Parts and Labor Warranty.

27. Interwiring of temperature monitor panel to master building alarm system or to the Owner's network. Technology department to provide all interfacing of alarm system and with the building alarm system. Conduit from refrigeration system to monitor by Division 26. Temperature Monitor installation at 4'-0" above finished floor. All conduit to be located above walk-in cooler/freezer ceiling. Exposed electrical conduit is not acceptable.
28. Manufacturer Representative to provide training on controls and inside emergency release mechanisms.

ITEM NO. 103 COLD STORAGE REFRIGERATION SYSTEM

QUANTITY 1

Manufacturer:	RDT
Model:	ZS1-2 EcoSmart
Size and Shape:	Refer to drawings
Alternate:	---

1. Air cooled system.
2. Semi-hermetic compressors only.
3. Cooler temperature to be +35 degrees.
4. Freezer temperature to be -10 degrees.
5. EcoSmart system on demand defrost.
6. Refrigeration system to accommodate 110F ambient exterior temperature. Coils to be oversized by 20%.
7. S/S covered housing.
8. A dedicated electrical connection to be provided for heated condensate drain line. Refer to electrical plan for location.
9. All exterior piping to be aluminum wrapped.
10. System to accommodate Item No. 102 Cold Storage Assembly.
11. S/S covered housing mounted to a 24" tall 1/8 galvanized angle iron frame anchored to concrete pad. Provide S/S skirting around frame.
12. Mount condensing unit on common exterior rack. Refer to Architectural and Engineering drawings for exact location of remote unit. Coordinate routing of refrigeration lines and conduit with appropriate trades. Heat tape and insulate all drain lines. General Contractor to seal all building penetrations at refrigeration lines.
13. Provide two (2) year parts and labor warranty for all parts and components (including third-party components that may be utilized).

ITEM NO. 104 COLD STORAGE SHELVING

QUANTITY 2

Manufacturer:	Metro
Model:	Metro Max Q
Size and Shape:	Refer to drawings
Alternate:	AMCO

1. Each unit to be four (4) tiers high with open grid mats.
2. Four (4) 74" post per unit. Provide foot plates at all posts when assembly is supplied with walk-in floor.
3. Refer to drawings for size, width and lengths.

4. Quantity Two (2) to equal One (1) lot: all shelving shown within cold storage assembly.
5. Verify shelving requirements with approved submittal prior to ordering.

ITEM NO. 105 DUNNAGE RACK

QUANTITY 6

Manufacturer:	Metro
Model:	Bow Tie Series
Size and Shape:	Refer to drawings
Alternate:	AMCO

1. Size as shown.

ITEM NO. 107 DRY STORAGE SHELVING

QUANTITY 1

Manufacturer:	Metro
Model:	MetroMax Q
Size and Shape:	Refer to drawings
Alternate:	AMCO

1. Each unit to be five (5) tiers high with open grid shelving.
2. Four (4) 86" posts per unit.
3. Quantity One (1) to equal One (1) Lot: all shelving shown within the dry storage room.
4. Refer to drawings for size, width and lengths.
5. Verify shelving requirements with approved submittal prior to ordering.

ITEM NO. 109 ICE MAKER WITH BIN

QUANTITY 1

Manufacturer:	Manitowoc
Model:	UYT-0190A
Size and Shape:	Refer to drawings
Alternate:	---

1. Energy Star Rated.
2. Stainless steel bin.
3. Stainless steel legs.
4. Provide bin adapter kit as required.
5. Easy Touch Controls, set filter reminders, get error messages/faults, program run/stop times, display serial/model information, view step-by-step cleaning/sanitizing prompts, view warranty expiration timer.
6. Provide Luminice II Virus and Bacteria Inhibitor.
7. Provide sizes and quantities as required: Dormont s/s water disconnect from filter to Ice Machine.
8. Cord and plug assembly, coordinate NEMA configuration with electrician.
9. One (1) pre-filter and water filter sized to manufacturers recommendations. Provide two (2) sets of replacement filters. Mount on wall adjacent to ice machine in an easily accessible location.
10. Coordinate cord and cap with receptacle. Water supply to filter to be hard copper plumbed. 72" long flex hose from filter to ice maker with 48" wall restraint cable. Interconnection thru water filter

to ice machine and final connection by Division 22. Water filter overflow tube to be strapped to back side of ice machine and extend to 1" above floor sink.

ITEM NO. 110B STACKED WASHER & DRYER

QUANTITY 1

Manufacturer:	Whirlpool
Model:	Residential
Size and Shape:	Refer to drawings
Alternate:	GE

1. Washer:
2. 3.5 cubic ft. capacity.
3. Straight vane agitator.
4. 9 wash cycles
5. 4 water temperatures.
6. "Quick pak" sound insulation.
7. Color to be white.
8. Water and drain hoses.
9. Dryer:
10. 5.9 cubic ft. capacity.
11. 4 Drying cycles
12. Auto dry.
13. Color to be white.
14. To include dryer cord and vent kit.
15. Units to include model stationary assembly including: white stack stand, dryer wall mount kit,door latch kit.
16. Contractor to provide current model numbers at the time of delivery.

ITEM NO. 111W WALL MOUNTED OVERSHELF

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. #18 gauge stainless steel, 12" deep, wall mounted overshelf. Size per plan.
2. 14 gauge s/s brackets.
3. Coordinate height with equipment below.
4. Special instructions: Shelving furnished and installed by 11 40 00. G.C. to provide wall blocking when required. 11 40 00 to coordinate size and location of wall blocking.
5. Manufacturer in lieu of custom: Metro, Super Erecta; Wall shelving including: Two (2) model #1WD14 brackets, brite finish, One (1) model #1448 shelf, brite finish and Four (4) model #9997C hole plugs, chrome finish. Locate above Washer and Dryer assembly.

ITEM NO. 121 TWO COMPARTMENT SINK W. DISPOSER

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S marine edge with 2" turndown at free sides.
2. Open base construction.
3. 10" high splash where adjacent to walls/fixtures.
4. Two (2) 24" x 26" x 15" deep sink compartments.
5. One (1) T&S model no. B-0291, splash mount faucet, 18" swing nozzle,LL inlets, for ¾" hot and cold water connections.
6. Two (2) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. Provide One (1) T&S model no. B-0133-EE-CR-8C pre-rinse, ***two (2)*** B-0108-C spray head, two(2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
8. 16 gauge S/S undershelf per drawings.
9. Disposer - installed in top integrally welded disposer cone. Notch and punch splash turn back for vacuum breaker. 14 gauge S/S bracket mounted below counter top for disposer control panel ground and polished to match top.
10. 12" deep single post mounted overshelf at 18" above counter top, punched to accommodate spray rinse.
11. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x ¼" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. Verify height with owner.
12. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 14 gauge S/S bracket ground and polished to match top. Hose and spray nozzle by owner.
13. Omit rear rail at sink compartments, disposer and front rail at hose bibb.
14. Two (2) "Richlite" ½" thick removable sink covers installed at each sink. Weld ¼" bar stock, set 5/8" below work surface at all four corners for support of sink covers. Two (2) finger holes per board.
15. Provide top and bottom c-channel support storage for sink covers at right or left end of counter.
16. One (1) Edlund model no. S-11 Manual can opener, mounted on raised platform.
17. Flanged feet at front only.
18. Seal at all splash penetrations.

ITEM NO. 123 DISPOSER-CONE MOUNT

QUANTITY 2

Manufacturer:	Salvajor
Model:	300-CA-18-ARSS -LD
Size and Shape:	Refer to drawings
Alternate:	In-Sink-Erator

1. Fixed nozzle.

2. Delete standard syphon breakers and provide T & S B-0456-04 vacuum breakers and mount 6” from tabletop to base of breaker.
3. Solenoid valve.
4. Flow control.
5. Model no. ARSS-LD control panel.
6. Auto-reverse.
7. Dejamming tool.
8. Install vacuum breaker in splash
9. S/S cone cover.
10. Perforated silver saver and disposer cone with scrap ring.
11. Two (2) Swirl inlet located in disposer cone at a 45 degree angle.
12. GC to pipe 1/2" cold water to disposer body and swirl inlets. Excess electrical cord to be secured to fabrication as required. Install into counter by section 114000.

ITEM NO. 128 UTILITY CART

QUANTITY 6

Manufacturer:	Lakeside
Model:	522
Size and Shape:	Refer to drawings
Alternate:	Piper

1. Four (4) N.S.F. approved non-marking casters, Two (2) with brakes.
2. Extended perimeter bumper.

ITEM NO. 136 BAKER'S TABLE

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S with 2" square turn down at front, 6" high enclosed splash at sides and rear.
2. Provide finished back at exposed backsplash.
3. 12" deep post mounted overshelf at 18" above counter top.
4. 18 gauge butt joint wall panel from splash to underside of shelf.
5. 16 gauge S/S flour trough.
6. Rear rail only.
7. One (1) lot Rubbermaid no. FG360288WHT ingredient bins.
8. One (1) tier of three (3) 20" x 20" x 5" deep all stainless steel drawers. To be in #18 gauge stainless steel housing having 3/4" radius (vertical) exterior corners. S/S drawer liners.

ITEM NO. 138.1 PAN RACK-ROLL IN

QUANTITY 12

Manufacturer:	CresCor
Model:	207-UA-12-AC
Size and Shape:	Refer to drawings

Alternate: Lakeside

1. Four (4) 5" High heat casters with brakes.
2. Adjustable universal slides on 1-1/2" centers.
3. 64" height.
4. Coordinate pan rack with roll-in cabinets.

ITEM NO. 145 WORKTABLE W. SINK & DBL BAR UT RACK

QUANTITY 2

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Top: 14 gauge type 304 S/S, 2" turn down at all sides.
2. Provide table in two (2) sections-one (1) 27" and one (1) 33" section. Refer to detail.
3. Open base construction.
4. Full length 16 gauge S/S undershelf.
5. Four (4) 20" W x 20" L drawer assemblies. Component Hardware #S52-2020 drawer slides with delrin bearings - 200lb capacity. Component Hardware #S81-2020C drawer pan.
6. One (1) 15" x 20" x 10" deep sink compartment. Coordinate location with drain overflow.
7. One (1) T&S model no. B-0320-BB-CR, rigid gooseneck, ceramic cartridges, deck faucet for ¾" hot and cold water connections.
8. One (1) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
9. Post mounted double bar utensil rack, extend 1-5/8" diameter S/S posts from cross rail thru top and weld Two (2) full length 2" x 1/4" S/S bars with 12" radiused outside ends and One (1) additional bar between post with Component Hardware model no. V-77-4401 sliding hooks at 8" on center. Provide gussets for posts at countertop penetrations. Verify height with Owner. 48" max. upright post spacing.
10. Provide a duplex receptacle and housing mounted below countertop per drawings. Interconnect and prewire a 5'-0" cord and plug out of receptacle housing for plugging into ceiling drop cord receptacle. 114000 and Div. 26 to coordinate location of drop cord receptacle.
11. Omit rear cross rail at sink section.
12. Flanged feet, secured to the floor with non corrosive anchors.

ITEM NO. 151 FIRE PROTECTION SYSTEM

QUANTITY 2

Manufacturer: Ansul
Model: R102
Size and Shape: Refer to drawings
Alternate: ---

1. Duct and plenum protection to exhaust hood.
2. Surface protection for cooking equipment.
3. Locate remote fire pulls as recommended by Fire Marshal.

4. One (1) lot Mechanical gas valve (maximum diameter as required). Size as required. Furnished by Section 114000, installed by Division 22. Kitchen Equipment Contractor to coordinate location with local Fire Marshal requirements prior to submittal review. All conduits to be recessed within wall, SURFACE MOUNTING WILL NOT BE ACCEPTED.
5. System to meet U.L. 300 requirements.
6. Provide one (1) hand held Type 'K' and ABC 6 liter fire extinguisher per Ansul System, surface wall mounted. Verify mounting locations as required.
7. Exposed pipe threads are unacceptable.
8. All exposed piping to be chrome plated.
9. All hood penetrations to have U.L. listed "Quick Seal". Provide s/s escutcheons at all hood penetrations.
10. Provide phenolic I.D. labels for exhaust hood, remote fire pull, light/fan switches and fire protection system.
11. Provide a manufacturer performance test and report that verifies this system is fully operational.
12. Provide s/s cabinet as shown on plan.
13. Installer to provide one (1) Ansul system per exhaust hood, review drawings and provide systems as required.
14. Install hand held extinguishers, maximum of 3'-2" A.F.F. to top of unit.

ITEM NO. 152 EXHAUST HOOD

QUANTITY 1

Manufacturer:	Mod-U-Serve
Model:	W-CPB
Size and Shape:	Refer to drawings
Alternate:	---

1. Size and shape as per plan.
2. Supply Air. Ceiling mounted supply plenum with light fixtures, coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
3. Supply Air. Recess mounted ceiling plenum box. Provide adjustable dampers that are easily accessible. Coordinate supply air, outside or tempered air (W-CPB) with engineer. Insulated make-up air plenum with 1" thick foil faced fiberglass insulation.Locate supply plenum in ceiling, coordinate location with GC as required.
4. U.L. Listed and fire rated 48” recessed LED lights located within the hood canopy. To meet minimum requirements of 50’ candles of illumination.
5. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.
6. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.
7. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
8. All 18 gauge S/S construction. S/S finish where exposed.
9. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.
10. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
11. S/S filters and grease cup. Provide filter removal tool.

12. ½" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
13. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
14. S/S c-channel closure panel from top of hood to ceiling.
15. S/S filler panel between hoods if back-to-back.
16. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
17. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
18. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
19. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
20. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
21. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
22. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
23. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

ITEM NO. 153 EXHAUST HOOD

QUANTITY 1

Manufacturer:	Mod-U-Serve
Model:	W-CPB
Size and Shape:	Refer to drawings
Alternate:	---

1. Size and shape as per plan.
2. Supply Air. Ceiling mounted supply plenum with light fixtures, coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
3. Supply Air. Recess mounted ceiling plenum box. Provide adjustable dampers that are easily accessible. Coordinate supply air, outside or tempered air (W-CPB) with engineer. Insulated make-up air plenum with 1" thick foil faced fiberglass insulation.Locate supply plenum in ceiling, coordinate location with GC as required.

4. U.L. Listed and fire rated 48” recessed LED lights located within the hood canopy. To meet minimum requirements of 50’ candles of illumination.
5. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.
6. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.
7. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
8. All 18 gauge S/S construction. S/S finish where exposed.
9. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.
10. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
11. S/S filters and grease cup. Provide filter removal tool.
12. ½" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
13. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
14. S/S c-channel closure panel from top of hood to ceiling.
15. S/S filler panel between hoods if back-to-back.
16. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
17. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
18. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
19. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
20. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
21. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
22. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
23. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

ITEM NO. 161 CONVECTION OVEN

QUANTITY 3

Manufacturer:	Blodgett
Model:	DFG-200 DBL
Size and Shape:	Refer to drawings
Alternate:	Vulcan

1. S/S front, top and sides.
2. Two (2) 1/2 HP 2-speed motors.
3. Natural gas.
4. SSI-M solid state infinite control with manual timer.
5. Electronic spark ignition.
6. Five (5) oven racks per compartment.
7. Dual pane thermal windows.
8. Simultaneous door operation.
9. Heavy duty casters, two (2) with brakes.
10. Provide quantities and sizes required: Dormont Model #VER-KIT-2S-48” Gas Conn. Kit, 48” long, Moveable Gas Connector Kit, covered with stainless steel braid, coated with blue antimicrobial PVC, SnapFast® Quick Disconnect, Swivel MAX®, full port valve, coiled restraining cable with hardware, limited lifetime warranty.
11. Dedicated gas connections, do not manifold.
12. Shunt trip breaker by Division 26.
13. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

ITEM NO. 163.1 30 GAL. TILT BRAISING PAN- GAS POWER TILT

QUANTITY 1

Manufacturer:	Groen
Model:	BPP-30GA
Size and Shape:	Refer to drawings
Alternate:	Cleveland

1. PowerPan tilt braising pan with easyDial Controls, selector dial with LED ring, large display screen.
2. Power tilt with spring-assisted cover with vent.
3. S/S construction.
4. Open leg frame.
5. Steamer pan inserts.
6. Pan carrier.
7. Etch marks.
8. Double pantry swing faucet.
9. Flanged feet. Secure rear to floor with non-corrosive anchors.
10. Provide quantities and sizes required: Dormont Model #VER-KIT-2S-48” Gas Conn. Kit, 48” long, Moveable Gas Connector Kit, covered with stainless steel braid, coated with blue antimicrobial

PVC, SnapFast® Quick Disconnect, Swivel MAX®, full port valve, coiled restraining cable with hardware, limited lifetime warranty.

11. Trench Liner to consist of:
12. S/S trench liner by 114000. Installation by G.C.
13. IMC/Teddy or Custom Fabricated.
14. Fibergrate: Gray #2 1" Thick, 1 1/2" squares mesh, Quartz grit top. Provide in two (2) equal sections, all ends to be finished ends.
15. 14 gauge s/s liner
16. IMC Teddy model no. BSPC basket strainer with pullout handle and chain.
17. Location of trench liner is critical. G.C. and 114000 to verify location prior to concrete pour. Oversize trench liner block out to accommodate equipment pour path.

ITEM NO. 165A TWO BURNER RANGE

QUANTITY 1

Manufacturer:	Southbend
Model:	P16C-X
Size and Shape:	Refer to drawings
Alternate:	Vulcan

1. S/S sides and front.
2. Cabinet base with removable shelf.
3. Removable cast iron grates.
4. Removable drippings tray.
5. 1" rear gas connections.
6. Casters (2 locking).
7. External pressure regulator.
8. S/S front end caps at manifold.
9. Provide integral model no.P8C-Spreader cabinet and T&S faucet model no. 43-073. Provide heat shield at faucet.
10. Provide Battery Spark Ignition and Flame Failure.
11. Provide quantities and sizes required: Dormont Model #VER-KIT-2S-48” Gas Conn. Kit, 48” long, Moveable Gas Connector Kit, covered with stainless steel braid, coated with blue antimicrobial PVC, SnapFast® Quick Disconnect, Swivel MAX®, full port valve, coiled restraining cable with hardware, limited lifetime warranty.
12. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

ITEM NO. 168 S/S WALL CAP

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. 2" square turndown at free ends.

2. Caulk and seal at wall with clear silicone.
3. Eased edges at exposed corners.
4. Coved turn up at full height wall, extended to ceiling.
5. 18 ga. stainless steel corner guards located at all exposed corners of kitchen. 48" tall. Located at all corners within the kitchen area. Secure to wall with hidden fasteners.
6. Locate per drawings.

ITEM NO. 169 SS CORNER GUARDS

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Quantity (1) equals One Lot, located on every outside corner within kitchen.
2. 18 ga. stainless steel corner guards located at all exposed corners of kitchen. 48" tall. Located at all corners within the kitchen area. Secure to wall with hidden fasteners.

ITEM NO. 172 COMBI OVEN - GAS DBL

QUANTITY 1

Manufacturer:	Rationale
Model:	ICP6-FULL/6-FULL N/G
Size and Shape:	Refer to drawings
Alternate:	---

1. Pre-Installation Site Consultation, to verify building utilities and access are in place for the units ordered prior to units being installed on site.
2. 208/240V 1PH
3. Standard door hinging.
4. Six (6) 18" x 26" or twelve (12) 12" x 20" pan capacity, per unit.
5. Standard warranty: 2 year parts and labor, installation inspection/start up.
6. Doors hinged per drawings.
7. Combi-Duo Stacking Kit, mobile.
8. Cleaner Tablets
9. Care Tablets.
10. AutoDose option, with Cartridge chemicals.
11. Gastronorm Grid Shelf, qty. 3.
12. KEC to coordinate pan accessories with Owner prior to ordering.
13. Four hour chef training.
14. Heat shield.
15. Installation Kit "10", per unit, article number 8720.1560US.
16. Rational offers Certified Installation of units by Commercial Kitchens.
17. System installation to be reviewed by an authorized factory installer, provide report confirming installation meets factory's requirements.
18. Provide filtration system as recommended by manufacturer. Provide one set of replacement filters.

19. Provide sizes and quantities as required: Dormont s/s water disconnect from filter to Combi Oven,color coded for filtered and non-filtered water.
20. KEC to coordinate filtered and unfiltered water with Combi Oven, do not connect filtered water to unfiltered water connection.
21. Provide quantities and sizes required: Dormont Model #VER-KIT-2S-48” Gas Conn. Kit, 48” long, Moveable Gas Connector Kit, covered with stainless steel braid, coated with blue antimicrobial PVC, SnapFast® Quick Disconnect, Swivel MAX®, full port valve, coiled restraining cable with hardware, limited lifetime warranty.
22. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.
23. Water supply to have shut-off valve and back flow preventer furnished and installed by Division 22. Supply water to interconnect thru water filter and then to each oven. Indirect drain line to be ran outside of the footprint of the unit, coordinate location of the related floor sink.

ITEM NO. 201.1 SERVING COUNTER

QUANTITY 2

Manufacturer: Mod-U-Serve
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. CONSTRUCTION BASE:
2. Continuous semi open base, angle iron frame construction, with utility chase within counter. All electrical conduit and plumbing to be located within utility chase as required. counter. Utility chase to be fully accessible from operator side of counter with removable stainless steel panels.
3. All electrical to be pre-wired to load center. Electrical to be located in electrical conduit pipe, flex conduit to be kept to a minimum. Exposed conduit will not be accepted. All wiring to be numbered at all junctions, per circuit. Wiring diagram to be provided at each load center door. All receptacles mounted in the counter to be recess mounted and labeled.
4. Cashiers station to be integral with counter, lockable cashiers drawer, undershelf to accommodate owners POS System, outlet to accommodate POS system and data line.
5. S/S removable intermediate shelves and undershelves where possible.
6. Dedicated receptacle to accommodate beverage merchandising.
7. Provide remote on/off switch for beverage merchandising if location is not accessible.
8. Adjustable kickplates.
9. TRAYSLIDE OPTIONS:
10. Engineered stone trayslide located at 32" A.F.F. Verify corian selection prior to bidding if not specified. Stainless steel half round runners.
11. COUNTER COMPONENTS:
12. One (1) lot Alto Shaam HW series dry operation, size and shape per drawings, drop in hot food wells. Recess countertop at hot food wells to accommodate sheet pan.
13. One (1) lot Hatco drop in mechanical cold pan, 3 pan capacity unless counter drawings shows otherwise.
14. Bon Chef hot food well covers, verify color selection with architect.

15. SNEEZE GUARDS:
16. One (1) lot Elite IV modified hot food breath protector with mirror finish 1” round posts. Post to be vertical front post only with slight angle towards rear of counter. Self-service height tempered glass to be fixed mounted to angle section of post. No heat lamp or display light.
17. Frost top integral into sneeze guard glass shelf, refrigeration to be self contained with compressor housing located at undershelf.
18. Sneeze guards to be secured to base of counter and welded to countertop. If stone top construction, extend thru countertop and secure to base, provide matching color sealant to match countertop.
19. COUNTER FINISHES:
20. Engineered stone countertop located at 34" A.F.F. Verify corian selection prior to bidding if not specified. Submit 12" X12" sample to architect for approval.
21. Plastic laminate fronts. Color/pattern to be by Architect/Owner.
22. Counters to be factory installed, manufacturer to provide floor template and coordinate with mep and furr down requirements.
23. Manufacturers are to bid all items per specifications, deviations from the specified manufacturers or fabrication will not be accepted.
24. Counter template to coordinate with servery walls, furr downs, electrical and plumbing locations. KEC to coordinate installation and any site conditions with the Trade/General Contractor as required.
25. One (1) lot Moduserve chip racks.
26. **Special Instruction:** Modify counter base to accommodate Item 206 Refrigerated Air Screen.

ITEM NO. 212 MOBILE TRAY LOWERATOR

QUANTITY 2

Manufacturer: Piper
Model: ATCA-ST
Size and Shape: Refer to drawings
Alternate: Caddy

1. Wrap around bumper.
2. Solid S/S bottom with finger grip.
3. Verify tray size with owner.
4. Four (4) casters, Two (2) with brakes.

ITEM NO. 214 CASH REGISTER

QUANTITY 2

Manufacturer: Owner Furnished
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

ITEM NO. 249 THREE COMPARTMENT SINK NO DISPOSER

QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings

Alternate: ---

1. Top: 14-gauge S/S 3" high 1-1/2" rolled rim at free sides, 10" high splash at walls.
2. Open base construction.
3. Omit rear rail at sink.
4. Three (3) 30" x 26" x 15" deep sink compartment.
5. Two (2) T&S model no. B-0291, splash mount faucet, 18" swing nozzle, LL inlets, for ¾" hot and cold water connections.
6. Three (3) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. 12" deep single post mounted overshelf mounted at 18" above counter top.
8. 18-gauge butt jointwall panel from splash to underside of shelf.
9. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x ¼" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center.
10. 16-gauge S/S undershelf as per drawings.
11. Flanged feet at front only of counter.
12. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

ITEM NO. 250 CONVEYOR DISHMACHINE W. EXTERNAL BOOSTER

QUANTITY 1

Manufacturer: Hobart
Model: CL44-BAS
Size and Shape: Refer to drawings
Alternate: Champion

1. Dishwasher, conveyor type, single tank design, 202 racks/hour capacity, S/S construction, with automatic fill, auto timer, and 115 volt pilot circuit.
2. 15 KW Electric tank heat.
3. 480/60/3.
4. Verify direction of dishmachine with drawings.
5. One (1) Extended warranty - One (1) Year parts and labor.
6. Interior Chamber height to be 4" taller than standard.
7. Single point electrical connection for Motors, Controls and Tank Heat. Div. 26 to provide S/S disconnect switches located as per plans interconnected to dishmachine and external booster heater.
8. Two (2) vent cowls with 4 x 16 vent and damper. Provide 18 gauge stainless steel seamless duct risers 6" above finish ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel flange with all corners welded.
9. One (1) table limit switch with stainless steel cover to conceal back. Provided by Manufacturer / Installed by Div. 26.
10. Four (4) 20"x20" Peg racks.
11. Four (4) 20" x 20" sheet pan racks.
12. Two (2) 20" x 20" combination racks.
13. Vent fan controls.

14. Drain water tempering kit. Drain water tempering kit is to be installed by Hobart Service.
15. Peak Rate of drain flow = 38 gpm. Division 22 to provide and install backflow preventor between booster heater and filter. Final connection by Division 22. Coordinate location of electrical disconnects on free wall.

ITEM NO. 252 BOOSTER HEATER

QUANTITY 1

Manufacturer:	Hatco
Model:	C-30
Size and Shape:	Refer to drawings
Alternate:	---

1. Compact booster heater.
2. One (1) Brass Pressure Reducing Valve with By-Pass.
3. 6" adjustable S/S legs.
4. One (1) Phosphate water treatment unit. System to be located in an accessible location.
5. One (1) Shock Absorber.
6. S/S body and base.
7. Division 22 to provide and install backflow preventor between booster heater and filter. Final connection by Division 22. Interconnect to dishmachine by Division 22. Coordinate location of electrical disconnects on free wall. GC to insulate hot water from booster heater to dishmachine.

ITEM NO. 254 SOILED & CLEAN DISHTABLE

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S 3" high 1-1/2" rolled rim at free sides. 10" high splash at walls.
2. 14 gauge S/S recessed deposit shelf. Extend shelf through opening to be flush with wall at deposit side. Turn shelf down 2" at front with ¾" return at bottom (either scribed into partition or forming reveal). Shelf: integral with dishtable. Provide Component Hardware E32-4900 drain - extend drain line to floor sink.
3. 18 gauge butt joint wall panel from splash to underside of shelf.
4. Install Disposer as shown. Notch and punch splash turn back for vacuum breaker. 12 gauge S/S bracket mounted below counter top and polished to match top for disposer control panel.
5. Provide One (1) T&S model no. B-0133-EE pre-rinse, B-0108-C spray head, two (2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
6. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray rinse by owner.
7. One (1) 18" disposer cone.
8. Provide ½" slope in top towards dishmachine per the general specifications.
9. S/S corner filler at backsplash; slope to dishtable.
10. S/S cover to conceal table limit switch.
11. 2 1/2" backsplash at dishmachine portion, single thickness of s/s will not be accepted.

12. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

ITEM NO. 255 MOBILE DRYING RACK

QUANTITY 2

Manufacturer:	Metro
Model:	PR48VX3
Size and Shape:	Refer to drawings
Alternate:	AMCO

1. Four (4) tier, includes two (2) drop-ins and (1) cutting board/tray drying rack, built in Microban antimicrobial product protection.
2. Two (2) no. 5MPX casters per unit.
3. Two (2) no. 5MPBX locking casters per unit.

ITEM NO. 260 HAND SINK

QUANTITY 7

Manufacturer:	Advance Tabco
Model:	7-PS-50
Size and Shape:	Refer to drawings
Alternate:	---

1. 20 gauge stainless steel construction.
2. Basket drain and wall bracket.
3. Gooseneck faucet with wrist handles.
4. Soap and towel dispensers by Owner.
5. P-Trap assembly, delete open/close drain valve.
6. Custom fabricated removable end splashes on sides as required by code. Height same as rear splash.
7. Trade contractor to provide temperature adjustment valves as required.

ITEM NO. 268 31.5 REAR LOAD REF MERCHANDISER

QUANTITY 2

Manufacturer:	RPI Vienna
Model:	VIAS2-34-R-SQ-SC-INS-CON
Size and Shape:	Refer to drawings
Alternate:	---

1. Free standing, self contained refrigerated Grab & Go Merchandiser, sized per plan.
2. Bottom of front opening to be 34” AFF with stainless steel adjustable legs to align with counter height.
3. Stainless steel interior.
4. Stainless steel exterior.
5. Fully insulated glass to reduce condensation.
6. Pull down night shade with clasp/catch with magnetic closer.
7. Qty of three (3) tempered glass shelves with lights.

8. Two (2) bi-parting doors on rear.
9. Five (5) year compressor warranty.
10. Drain to floor sink. Floor sink to be located below Air Screen.
11. KEC to verify unit is 5-6’ away from air vents. Coordinate in field.
12. Rear air ventilation kit.
13. Cord and plug assembly.
14. Stainless steel trim as required to seal gaps at counters.
15. Provide submittal shop drawing for review by Consultant.
16. **Special Instruction:**Start-up and calibration of unit must be by factory authorized service agency, prior to customer demonstration. K.E.C. to coordinate 18” height clearance at top of unit.

ITEM NO. 738 ROLL-THRU REFRIGERATOR 1 DR

QUANTITY 2

Manufacturer:	Traulsen
Model:	RRI132HPUT-FHS - TALL
Size and Shape:	Refer to drawings
Alternate:	Utility

1. Stainless steel exterior and interior.
2. Interior lights with bulbs.
3. Locking hardware.
4. Furnish start-up and Six (6) years parts and labor warranty. Seven (7) years compressor warranty.
5. S/S Full height doors on both sides, hinged as per plan.
6. Controls to be on kitchen side of unit.
7. Omit plug. Unit to be hardwired.
8. Provide ramps.
9. Special Instructions: Provide opening in wall 2" taller than equipment and 2" wider, KEC to coordinate with GC as required. Trim is not to be secured to the equipment.

ITEM NO. 741 ROLL-THRU HEATED CABINET 2 DR

QUANTITY 2

Manufacturer:	Traulsen
Model:	RIH232HP-FHS - TALL
Size and Shape:	Refer to drawings
Alternate:	Utility

1. Stainless steel exterior and interior.
2. Interior lights with bulbs.
3. Locking hardware.
4. Furnish start-up and Six (6) years parts and labor warranty.
5. S/S Full height doors on both sides, hinged as per plan.
6. Re-hinging feature.
7. Controls to be on kitchen side of unit.
8. S/S removable trim at top of unit.
9. Provide ramps.
10. Fully welded telescoping S/S trim at walls. Trim is not to be secured to equipment.

11. Special Instructions: Provide opening in wall 2" taller and wider than equipment. KEC to coordinate opening with GC as required.

END OF FOODSERVICE EQUIPMENT

SECTION 11 46 83 - ICE MACHINES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Commercial ice machines
   2. Appliance coordination including service connections, supply lines, and power
   3. Accessories necessary for a complete installation

B. Related Sections:
   1. Division 22: Domestic water supply.
   2. Division 26: Electrical connection.

1.3 SUBMITTALS

A. Product Data: Technical data including product specifications, installation, and maintenance instructions.

B. Product Certificates: Submit certificate from product manufacturer stating compliance with requirements and intended use of product.

C. Operation and Maintenance Data: Submit for each residential appliance to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
   3. Energy Ratings: Provide energy efficient appliances that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information.
   4. Accessibility Requirements: Comply with applicable requirements.
      a. United States Access Board Americans with Disabilities Act Accessibility Guidelines (ADAAG) (2010 ADA Standards for Accessible Design).
      b. ICC A117.1 Accessible and Useable Building and Facilities.

B. Product Options: Information on Drawings and in Specifications establishes requirements for product's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

C. Source Limitations: Obtain light commercial appliances from single source and each type of light commercial appliance from single manufacturer.

D. Preinstallation Conference: Conduct conference at site.

1.5 WARRANTY

A. Warranties: Written warranty signed by manufacturer in which manufacturer of the specific appliance specified agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period.

1. Provide appliance and equipment rated for light commercial grade or higher. Residential appliances are not acceptable unless manufacturer warrants residential units in a commercial application and only with Architect's approval.

B. Icemaker, Sealed System: Full warranty, including parts and labor, for onsite service on the product.
   1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
   2. Warranty Period for Other Components: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufactuer's listed whose product meets or exceedds the specifications are approved for use on the project. Other manufacturers muat have a minimum of five (5) years experience manufactuering products meeting or excedding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

1. Manitowoc; WI; (920) 682-0161.

2. Hoshizaki America.; GA; (800) 438-6087.

3. Follet Ice; PA; (610) 252-7301.

2.2 APPLIANCES

A. Freestanding Ice Machine (Concessions Room):
   1. Basis of Design: Manitoiwoc. Model IYT1200A.
   2. Dimensions: 30 inches wide by 29 1/2 inches high.
   3. Finish: Stainless Steel.
   4. Ice Production: Minimum 1,213 llbs.
   5. Refrigerant: R410A.
   6. Electrical: 208 V x 60 Hz x 1 PH.
   7. Cube Type: Half Dice.
   8. Accessories: Ice scoop and related accessories necessary for a complete installation and use.

B. Under-counter Freestanding Ice Machine (Teachers Lounge, Clinic, and training room):
   1. Basis of Design: Manitowoc, Model UYF-0310A.
   2. Ice Type: Half-Dice.
   3. Daily Production: 235 pounds.

C. Ice Bin:
   1. Basis of Design: Manitowoc, Model D970.
   2. Storage Capacity: 882 lbs.
   3. Provide one (1) ice bin for each non-under-counter ice machine in the construction documents.

D. Appliances, Equipment, and Fixtures: Coordinate equipment, fixtures, appliances regardless which party provides or furnishes. Ensure adequate power supply and properly locate plumbing lines and hook ups, water and drain connections and accessories.

E. Accessories: Provide accessories necessary for a working installation.

2.3 FINISHES

A. Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Stainless Steel Finish: Provide appliances with standard finish complying with manufacturer's written instructions for surface preparation including ground and polished stainless steel surfaces for uniform, directionally textured finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances and conditions affecting performance of work. Coordinate installation of equipment, appliances, fixtures, and other items.
   1. Examine roughing in for piping systems and verify actual locations of piping connections before equipment installation.
   2. Examine electrical circuits and rating and verify locations and sufficient ratings for items requiring electrical power.
   3. Examine space to receive items and verify the space is of sufficient size and configuration for items.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions. Install fixtures level and plumb according to roughing in drawings.

B. Power Supply: Coordinate power supply, grounding, outlets, and electrical wiring with locations indicated for appliances and equipment.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to plumbing and electrical sections for plumbing and electrical requirements.

E. Connections and Hook ups: Coordinate location of services.
   1. Grounding: Ground equipment in accordance with applicable standards and code requirements.
   2. Wiring: Connect wiring in accordance with manufacturer recommendations.
   3. Provide necessary electrical outlets.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory authorized service representative:
   1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturer written recommendations. Certify compliance with each manufacturer appliance performance parameters.
   2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After installation, start units to confirm proper operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Test each equipment item to verify proper operation. Make necessary adjustments. Replace malfunctioning appliances and components, then retest. Repeat procedure until units operate properly.

3.4 CLEANING

A. Clean equipment with manufacturers' recommended cleaning methods and materials. After completing installation of equipment and fixtures, inspect exposed finishes and repair damaged finishes. Remove packing materials from site.

3.5 PROTECTION

A. Provide protective covering for installed appliances. Do not allow use of equipment items for temporary facilities.

3.6 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment.

END OF SECTION 11 46 83

SECTION 11 53 13 - LABORATORY FUME HOODS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

B. Related Sections:
   1. Section 06 10 00 - Rough Carpentry: Blocking and nailers for anchoring fume hoods.
   2. Section 09 21 16 - Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring fume hoods.
   3. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Field quality-control testing of fume hoods.

1.2 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z9.5 - Laboratory Ventilation; 2022.

C. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016, with Errata.

D. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

H. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

I. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

J. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2024.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

L. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals; 2019.

M. SEFA 1 - Laboratory Fume Hoods; 2010.

N. SEFA 2 - Installations; 2010.

O. UL 1805 - Standard for Safety Laboratory Fume Hoods and Cabinets; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

B. Preinstallation Meeting: Conduct preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide fume hood exterior and interior dimensions and construction, utility and service requirements and locations.

C. Shop Drawings: Indicate locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required, locations and types of service fittings.

D. Samples: Submit two samples of exterior, interior, and work top finish surfaces, in size illustrating color and finish.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Provide documentation of successful Factory Acceptance Testing.

F. Test Reports: Indicate that each type of fume hood has been factory-tested and meets specified ASHRAE Std 110 (AM) requirements.

G. Manufacturer's Installation Instructions: Indicate special installation requirements.

H. Operation Data: Include description of equipment operation and required adjusting and testing.

I. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Project Record Documents: Record actual locations of concealed utility connections.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Testing: Factory-test each type of hood as per referenced standard.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.7 FIELD CONDITIONS

A. Ambient Conditions: Maintain temperature and relative humidity at occupancy levels during and after installation of fume hoods.

1.8 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide one year manufacturer warranty for manufacturer's standard items (listed by part number in manufacturer's official publication).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

1. Metal Laboratory Fume Hoods:
    a. Kewaunee Scientific Corp: www.kewaunee.com/#sle.
    b. Mott Manufacturing Ltd: www.mott.ca/#sle.

c. Multilab: www.multilab.net/#sle.

2. Polypropylene Laboratory Fume Hoods:
   a. LabAire Systems, a Division of Activar Plastic Products Group, Inc: www.labairesystems.com/#sle.
3. Laboratory Fume Hood Monitors:
   a. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   b. Triatek: www.triatek.com/#sle.
   c. TSI Inc: www.tsi.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

C. Provide laboratory fume hoods from single manufacturer.

D. Provide laboratory fume hoods from same manufacturer as laboratory casework.

2.2 CONSTANT AIR VOLUME (CAV) FUME HOODS

A. Bypass Fume Hoods:
1. Include a built-in compensating bypass arrangement to maintain constant exhaust volume regardless of sash position.
   a. Design bypass functionality so that face velocity as the sash is being closed down to 6 inches (152 mm) does not exceed three times the face velocity with sash fully open.

B. Auxiliary Air System:
1. Include an-air outlet for connection to an external supply air source equal to 70 percent of the exhausted air volume. Introduce air directly above and immediately in front of hood face.

2.3 VARIABLE AIR VOLUME (VAV) FUME HOODS

A. Restricted-Bypass Fume Hoods:
1. Provide a compensating bypass arrangement above the sash to open after sash is closed to less than 20 percent open. Bypass to maintain exhaust capacity of at least 25 CFM per square foot (127 L/s per square meter) of work surface regardless of sash position.
2. Provide an electronic control unit designed to use input from a sensor that monitors face velocity or sash position to modulate a dedicated exhaust damper in order to maintain a near-constant fume hood face velocity.
   a. Provide control unit with a manual-override switch that allows the operator to fully open the exhaust damper.
   b. Provide control unit with outputs for interfacing with building's HVAC control system.

2.4 PERFORMANCE REQUIREMENTS

A. Fume hoods complying with the following when tested in accordance with ASHRAE Std 110:
1. As-Manufactured (AM) Rating: AM 0.01 (0.01 ppm).
2. As-Installed (AI) Rating: AI 0.10 (0.10 ppm).
3. Average Face Velocity: 100 FPM (0.51 m/s) plus or minus 10 percent with sashes fully open.
4. Face-Velocity Variation: Not more than 10 percent of average face velocity across the face opening with sash(es) fully open.
   a. Test hoods with horizontal sashes with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
   b. Test hoods with combination sashes fully raised, with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
5. Release Rate: 4.0 L/min.
6. Static-Pressure Loss: Not more than 1/2-inch w.g. (124 Pa) at 100 FPM (0.51 m/s) face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

7. Seismic Performance: Design fume hoods, including attachments to other work, to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
    a. Refer to Drawings for Design earthquake spectral response acceleration, short period (Sds) for Project.
    b. Component Importance Factor: 1.0.

2.5 FUME HOODS

A. General Requirements:
1. Comply with SEFA 1.
    a. Provide fume hoods UL listed and labeled for compliance with UL 1805.
2. Pre-pipe fume hoods for service fittings.
3. Pre-wire fume hoods for light fixtures and receptacles.
    a. Terminate all wiring in a junction box on top of hood.

B. Fume Hood:
1. Basis of Design: 90273ADA as manufactured by Sheldon Laboratory Systems.
2. Ventilation: Variable Air Volume (VAV).
3. Configuration: Standing-height; bench mounted.
4. Nominal Interior Height: 48 inches (1219 mm).
5. Sash Type: Vertical rising.
    a. Configuration: As indicated on drawings.
    b. Leak-free enclosure box, manufacturer's standard construction, for vertical rising sash.
    c. Horizontal Sashes: By-passing and removable sashes hung from adjustable nylon-tired, ball-bearing sheaves, supported on an overhead stainless-steel track; lower track only for guiding sashes; flush finger pulls and rubber bumpers at both stiles of each sash.
    d. Glazing: Laminated safety glass.
    e. Sash Guides: Corrosion-resistant polyvinyl chloride (PVC) track.
    f. Vertical Sash mechanism: Designed to prevent sash drop in case of mechanism failure.
        1) Cable: Minimum 3/32 inch (2 mm) thick stainless steel of construction standard with the manufacturer.
            (a) Sprocket system for Sash Chain: Hardened sprockets with one full-width shaft per sash, running in ball-bearings.
    g. Vertical Sash Pull: Type 316 stainless steel, with No.4 finish.
    h. Sliding Safety Shield: Manufacturer's standard removable polycarbonate shield able to slide the full width of fume face opening, with ball-bearing rollers at top for suspension from track at top of sash opening, and guide at bottom to keep shield from swinging.
6. Top Front Panel: Standard integral grille stamped into panel of same materials as fume hood exterior.
7. Exterior: Sheet steel.
    a. Color/Finish: To be selected by Architect from Manufacturer's full range of color options.
8. Interior Lining: Polypropylene.
    a. Color/Finish: White.
9. Service Fittings and Fixtures:
    a. Cup Sink : Drop-in Epoxy, complete with removable stainer and waste fitting, side-mounted at floor-mounted fume hood.
        1) Shape: Round.
        2) Size: 5 inch (127mm) diameter.
10. Access Panels: Provide removable panels on both sides hood exterior and interior lining panels.

11. Work Surface:
    a. Work Top for Fume Hoods Other Than Floor-mounted Type: Epoxy resin.
        1) Edge: Raised rim with rounded edges and corners.
        2) Full width drain trough at rear.
    b. Floor at floor-mounted fume hoods :
        1) Material: Solid epoxy, 1 inch (25 mm) thick with 1/2 inch (13 mm) high, raised (marine) edge.
        2) Distillation Shelf: Manufacturer's standard shelf, attachable to side walls of fume hood.

C. Fume Hood Base Cabinets:
    1. Exterior construction: Wood Cabinets.
        a. Standard storage cabinets.
        b. Acid storage cabinets.
        c. Solvent storage cabinets.
        d. Vacuum pump cabinets.
        e. _____.
    2. Material: Sheet steel.
    3. Color/Finish: As indicated on drawings.

D. Fume Hood Base Stands:
    1. Construction: Welded steel tubing legs, not less than 2 inch (51 mm) square.
        a. Color/Finish: As indicated on drawings.
    2. Vertical Adjustment Mechanism: Manual telescoping. Work surface height range from 30 inches (762 mm) to 37 inches (940 mm).
    3. Leg Levelers: Manufacturer's standard.
    4. Leg Shoes: Manufacturer's standard.
    5. Casters: Manufacturer's standard.
    6. Structural Performance: Capable of withstanding 50 pounds per foot (74 kg/m) work top, 75 pounds per foot (112 kg/m) on work top, plus weight of hood, without permanent deformation or excessive deflection.
    7. Structural Performance of Fume Hood Base Stands for Radioisotope Hoods: Capable of withstanding 50 pounds per foot (74 kg/m) work top, 200 pounds per foot (297 kg/m) on work top, plus weight of hood, without permanent deformation or excessive deflection.
    8. Knee Space: Clear floor space not less than 36 inches (915 mm) wide by 25 inches (635 mm) front-to-back by 27 inches (685 mm) high, unless otherwise indicated.

E. Light Fixtures: UL labeled, vaporproof, one-tube, T-5 fluorescent light fixtures. Number and length of fixtures as necessary for fume hood width. Mounted above sealed safety glass panel. White baked-enamel finish on fixture interior.
    1. Average Interior Illumination Level: 80 footcandles.
    2. Coordinate access to light fixture with ceiling extension configuration and construction.

2.6 FABRICATION

A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations, or as necessary to permit movement through a 35 inches by 79 inches (889 mm by 2007 mm) clear door opening.

B. Steel Exterior: Fabricated from steel sheet, 0.048 inch (1.21 mm) thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Chemical-resistant finish applied to interior and exterior surfaces of component parts before assembly.

C. Stainless-Steel Exterior: Fabricated from stainless-steel sheet, 0.050 inch (1.27 mm) thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil, and to allow access to plumbing lines and service fittings.

D. Fiberglass Exterior: Fabricated from glass-fiber-reinforced polyester components not less than 1/4 inch (6.35 mm) thick, bonded together to maximum extent practical. Edges of panels trimmed with PVC extrusion. Removable parts limited to access panels, front fascia, and airfoil.

E. Polypropylene Exterior: Fabricated from fully stress-relieved polypropylene sheet, 1/2 inch (12.7 mm) thick, with welded seams. 1/4 inch (6.35 mm) thick, flush mounted access panels fastened with flat-head polypropylene screws.

F. Ends: Fabricated with double-wall end panels. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

G. Splayed top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.

H. Front Double-Wall Posts: Pre-punched to accept up to five (5) plumbing fixtures per side; two (2) duplex electrical receptacles; light switch; airflow indicator and alarm.

I. Lining Assembly: Unless otherwise indicated, assembled with stainless-steel fasteners or epoxy adhesive, concealed where possible. Joints sealed by filling with chemical-resistant sealant during assembly.
   1. Lining components fastened together with stainless-steel cleats or angles to form a rigid assembly to which exterior panels are attached.
   2. Lining components fastened to a rigid frame assembly fabricated from stainless-steel and to which exterior panels are attached.
   3. Punched fume hood lining side panels for service fittings and remote controls. Removable plug buttons for holes not used for indicated fittings.

J. Molded Glass-Fiber-Reinforced Polyester Lining: Molded unit consisting of end panels, back panel, preset rear baffle, and top bonded together into a single piece; reinforced to form a rigid assembly to which exterior is attached.
   1. Punched fume hood lining side panels for service fittings and remote controls. Removable plug buttons for holes not used for indicated fittings.

K. Stainless-Steel Lining Assembly: Fully-welded unit consisting of end, back, and top panels, and work top with spill-containing raised edges; reinforced to form a rigid assembly.
   1. For perchloric acid and radioisotope fume hood linings: Coved corners and completely welded seams; surfaces ground smooth, and polished as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivated and rinsed surfaces; embedded foreign matter removed, leaving surfaces clean.

L. Rear Baffle: Same material as fume hood lining, unless otherwise indicated, at rear of hood with openings at top and bottom, with corrosion-resistant fasteners. Fabricated for removal to facilitate cleaning behind baffle.
   1. Preset baffles, unless otherwise indicated.
   2. Adjustable baffles with control adjustment strips at top and bottom with plastic or stainless-steel knobs,.
   3. Adjustable baffles with remote-control adjustment from outside front of fume hood, unless otherwise indicated.
   4. Epoxy-coated, stainless-steel screen at bottom baffle opening to prevent light items from being drawn into the rear exhaust plenum.

M. Exhaust Plenum: Full width of fume hood, sized and configured to provide uniform airflow, of same material as hood lining, and with duct stub for exhaust connection.
   1. Duct-Stub Material: Epoxy-coated steel, unless otherwise indicated.
   2. Duct-Stub Material for Radioisotope Hoods: Stainless steel.

N. Bypass Grilles: At bypass openings of fume hoods.

O. Airfoil: At bottom of fume hood face opening, with 1 inch (25.4 mm) gap between bottom of airfoil and work top. Sash to close on top of airfoil. Designed to direct airflow across work.

1. Fabricated from 14 gauge, 0.0781 inch (1.98 mm) stainless steel with No.4 finish.

P. Filler Strips: As needed to close spaces between fume hoods and/or fume hood base cabinets and adjacent building construction. Fabricated from same material and with same finish as fume hoods or fume hood base cabinets, as applicable. Flange, notch, and reinforce filler strips. Fabricate to form well-fitting closures, free from oil-canning.

Q. Ceiling Extensions: Filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods, and extending from tops of fume hoods to approximately 4 inches (102 mm) above ceiling. Flange, notch, and reinforce ceiling extensions as required for rigidity. Fabricate to form well-fitting closures, free from oil-canning.
1. Provide bottom-hinged access panels within the front ceiling extension filler panel to facilitate access to light fixture and other fume hood components at top of hood not readily accessible by other means.

R. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.

S. Perchloric Acid Fume Hood Washdown System: System consisting of stainless-steel spray nozzles, washdown valve, and associated piping. Design system to thoroughly rinse all surfaces of fume hood interior, including areas behind and above baffles, and to direct rinse water toward drain trough at rear of work top. Provide T-fitting for extending system to additional spray nozzles in exhaust ducts.

T. Demonstration (teaching) Fume Hoods: Single chamber fume hood, with independently-operable sashes on opposite faces of fume hood. Construction similar to standard models.
1. Optional glazed viewing window on left side of fume hood.
2. Lattice Assemblies: Aluminum vertical and horizontal rod lattice assembly with 1/2 inch (12.7 mm) diameter rods at approximately 12 inches (305 mm) on center with two flush socket receptacles for mounting.
   a. Vertical Rods: For each assembly, two rods with tapered end to fit socket receptacles.
      1) Length: 48 inches (1219 mm).
   b. Horizontal Rods: For each assembly, one rod with rounded ends.
      1) Length: 24 inches (610 mm).
   c. Bases: Opening size coordinated with rod diameter, and including mounting screws appropriate to mounting substrate.
   d. Connectors: Opening size coordinated with rod diameter, open-type, closed-type, and rod-coupler-type, with T-handles.

U. Comply with requirements of other sections for factory installation of water and laboratory gas service fittings, piping, electrical devices, and wiring. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated.

2.7 MATERIALS

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666/A666M, Type 304, stretcher-leveled standard of flatness.
1. For perchloric acid fume hoods, use Type 316L instead of Type 304.

C. Glass-Fiber-Reinforced Polyester: Polyester laminate with a chemical-resistant gel coat on exposed faces, and having a flame-spread index of 25 or less according to ASTM E84.

D. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
1. Physical Properties:
   a. Flexural Strength: Not less than 10,000 pounds per square inch (70 MPa).
   b. Modulus of Elasticity: Not less than 2,000,000 pounds per square inch (1,400 MPa).
   c. Hardness (Rockwell M): Not less than 100.
   d. Water Absorption (24 Hours): Not more than 0.02 percent.

e. Heat Distortion Point: Not less than 260 degrees F (127 degrees C).
f. Flame-Spread Index: 25 or less according to ASTM E84.

2. Chemical Resistance: As follows when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
   a. No Effect:
      1) Acetic acid (98 percent).
      2) Acetone.
      3) Ammonium hydroxide (28 percent).
      4) Benzene.
      5) Carbon tetrachloride.
      6) Dimethyl formamide.
      7) Ethyl acetate.
      8) Ethyl alcohol.
      9) Ethyl ether.
      10) Methyl alcohol.
      11) Nitric acid (70 percent).
      12) Phenol.
      13) Sulfuric acid (60 percent).
      14) Toluene.
   b. Slight Effect:
      1) Chromic acid (60 percent).
      2) Dodium hydroxide (50 percent).
3. Color: Black.

E. Polypropylene: Unreinforced polypropylene complying with ASTM D4101, Group 01, Class 1, Grade 2.

F. Laminated Safety Glass: ASTM C1172.

G. Polycarbonate Glazing: Clear, uncoated polycarbonate sheet manufactured by extrusion process and complying with the following requirements:
1. Impact Resistance: 12 to 16 foot-pounds of force per inch (640 to 850 J/m) in accordance with ASTM D256, Method A.
2. Elongation and Modulus of Elasticity: 110 percent maximum and 340,000 pounds per square inch (2,345 MPa), respectively, in accordance with ASTM D638.
3. Heat Deflection: 270 degrees F (132 degrees C) at 264 pounds per square inch (1,820 kPa), in accordance with ASTM D638.
4. Flame-Spread Index: 25 or less, in accordance with ASTM E84.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Fasteners: Stainless-steel, where exposed to fumes.

2.8 ACCESSORIES

A. Differential Pressure Gauge: Direct-reading aneroid gauge that measures the difference in static pressure between the laboratory space and the fume hood exhaust duct.

B. Airflow Monitors/Indicators and Alarms: Provide each fume hood with a airflow monitor/indicator complete with an audible and visual alarm that activates when airflow sensor reading is outside of preset range.
1. Source: Fume hood manufacturer.
2. Airflow Monitor/Indicator Functionality:
   a. Type: A sensor module that monitors fume hood face airflow velocity, and a display module that indicates whether velocity it is below normal, normal, or above normal.
      1) Input Power: 9 to 30 V AC/DC. Include power supply module or functionality.
      2) Alarm Range: 50 to 250 FPM (0.25 to 1.27 m/s).
      3) Alarm Setpoints: Low.

4) Mounting: Flush.
5) Readings: Remote sensor inserted in airflow stream.
6) Accuracy: Maximum plus or minus 5 percent of set point.
7) Visual Status Display: Green, yellow, and red LEDs.
8) Operating Temperature: 55 to 86 degrees F (13 to 30 degrees C) .

b. Type: A sensor module that monitors fume hood face velocity, and a display module that presents data as digital readout.
1) Input Power: 9 to 30 V AC/DC. Include power supply module or functionality.
2) Display Range: 0 to 1,000 FPM (0 to 5.08 m/s).
3) Alarm Condition Range: 50 to 250 FPM (0.25 to 1.27 m/s).
4) Alarm Setpoints: Low and High.
5) Mounting: Flush.
6) Readings: Remote sensor inserted in airflow stream.
7) Accuracy: Maximum plus or minus 5 percent of set point.
8) Visual Status Display: Green, yellow, and red LEDs.
9) Airflow Display: Digital display of face velocity reading.
10) Operating Temperature: 55 to 86 degrees F (13 to 30 degrees C) .

3. Airflow Alarm functionality: Audible (85 dB @ 4 inch (102 mm) distance), and visual alarm that activates when airflow sensor reading is outside of preset range.
a. Reset and test mode.
b. Programmable Switch: Designed to silence audible alarm and automatically reset when airflow returns to within preset range. Warning light to stay on when alarm is silenced.
c. Programmable relay output.
d. Capability for integration with BAS (Building Automation System) via BACnet.
e. Alarm included as an integral feature of the airflow monitor/indicator.

C. Fume Hood Controller: Airflow Indicator/monitor with built-in electronics to control a dedicated exhaust fan and/or exhaust valve.
1. Fume hood manufacturer's standard controller.
2. Controller is part of a facility automation controls system.

D. Sash Alarms: Audible and visual alarm that activates when sash is opened beyond preset position.
1. Programmable silence and test switches.
2. Sash Alarm integrated with Airflow Alarm.

E. Sash Stops: Spring-loaded stops to limit hood opening to 18 inches (457 mm) height. Manually releasable to open sash fully, and to reset automatically when sash is lowered below set level.

F. Bypass Grille Blank-off Panel: On bypass grille, designed for use with sash stops to reduce exhaust air volume and provide design face velocity with sash at 50 percent open position.

G. Variable Transformer: On/off control switch and a transformer with single voltage input and variable voltage output, of the following configuration:
1. Single-Phase:
a. Input: 120 VAC; Output - 0 to 140 VAC.
b. Input: 240 VAC; Output - 0 to 280 VAC.
c. Input: 480 VAC; Output - 0 to 560 VAC.
2. Three-Phase, Wye:
a. Input: 240 VAC 3 phase; Output - 0 to 280 VAC.
b. Input: 480 VAC 3 phase; Output - 0 to 560 VAC.

2.9 EXHAUST BLOWERS

A. Dedicated exhaust blower at each fume hood indicated to be individually exhausted, of airflow capacity recommended by fume hood manufacturer.
1. Type: Direct drive.

2. Materials: Epoxy-coated steel.
3. Controls: On/Off using Fan switch located on fume hood post.
4. Model selection coordinated with building electrical services.
5. Model selection coordinated with expected static pressure losses in exhaust ductwork.

2.10 SOURCE QUALITY CONTROL

A. Refer to Section 01 40 00 - Quality Requirements, for additional requirements.

B. Factory testing of each type of fume hood.

C. Non-Complying Work: See Section 01 40 00 - Quality Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.

B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Large Components: Ensure that large components can be moved into final position without damage to other construction.

C. Comply with indicated requirements for installing water and laboratory gas service fittings, and electrical and telecommunications devices.
   1. Install fittings in accordance with shop drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods.

D. Exhaust Blowers:
   1. Turn over to appropriate trade contractor(s) for installation.

3.3 FIELD QUALITY CONTROL

A. Field test fume hoods as specified below.
   1. General: Test fume hoods as installed to assess airflow velocity. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for 100% of the hoods provided in the Project.
   2. Preparation:
      a. Inspect each fume hood to confirm its installation complies with drawings and specifications.
      b. Inspect laboratory space to verify that construction complies with drawings and specified requirements.
      c. Do not proceed with fume hood testing until an acceptable TAB report has been received.
      d. Verify that proper temperature and pressurization of the lab space can be maintained, with door(s) to the space in closed and open positions.
      e. Adjust non-complying physical and control systems until conditions favorable to testing fume hoods are present.
   3. Operating Conditions Tests:

a. Conduct face velocity tests to confirm that target velocities are being achieved within acceptable tolerances.
b. Conduct airflow indicator/monitor tests to confirm acceptable variation from corresponding measured value. Calibrate and adjust device to function within specified accuracy parameters.
c. Conduct exhaust flow and static pressure tests of the HVAC system and its controls to confirm flow volume and static pressures are within acceptable tolerances.
d. In projects with VAV lab ventilation systems, conduct response time and stability tests to confirm how the HVAC supply and exhaust systems respond to different sash opening positions.
e. Conduct tests of alarm device by shutting off the fume hood exhaust and verify that the individual fume hood alarm activates and operates in specified manner.
f. Conduct tests of individual controls provided at the fume hood (such as unoccupied cycle override, alarm override, etc.) to verify they operate in specified manner.

4. Containment Performance Tests:
   a. Conduct airflow visualization tests (local smoke challenges) to provide a visual indication of fume hood's capture performance.
      1) Coordinate disabling of local fire alarm system when performing this test.
      2) Compensate for smoke discharge velocity and exposure outside of the fume hood.
      3) If required to be performed, do not proceed with the large volume challenge test if the hood has failed the local challenge test.
      4) Record a video of the test(s).
   b. Conduct tracer gas containment tests, using mannequins to confirm gas concentrations meet (are below) specified criteria.
      1) Use tracer gas agreed-upon with Owner.

B. Field test installed fume hoods in accordance with requirements of Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

C. Reporting Requirements: Comply with Section 5 of NEBB Fume Hood Testing (FHT) Standard, current edition. Organize and include, at a minimum, the following information:
   1. Report title.
   2. Report certification.
   3. Table of contents.
   4. Report summary/remarks.
   5. Appropriate forms.
   6. Instrument calibration.
   7. List of abbreviations used.
   8. A room layout drawing for each tested item. Identify: walls; doors; fume hood(s); other present environmental enclosures (e.g. biological safety cabinet(s), laminar flow hood(s), canopy hood(s), etc.); location and airflow pattern of all air supply, return, and exhaust grilles, registers and diffusers.

3.4 ADJUSTING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand only. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

3.5 CLEANING

A. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.6 DEMONSTRATION

A. Demonstrate proper operation of fume hoods and their accessories to Owner's designated representative.

END OF SECTION 11 53 13

SECTION 11 57 00 - SHOP EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Provide fully operational shop equipment with accessories as specified to complete work as shown on drawings or required.

B. Furnish, install, hook-up and start-up the following shop equipment:
   a. Plasma Cutter.
   b. Welding Booth.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.
   3. Manufacturer's operation and maintenance instructions.
   4. Spreadsheet of all powered equipment submitted with required voltage and phasing, including voltage and phasing provided by electrical plans.

1.3 QUALITY ASSURANCE

A. Provide set-up and assembly of specified equipment by qualified manufacturer’s installer.

B. Equipment requires operational sign-off by Owner whether indicated or not.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in protective wrapping, store inside building protected from weather, moisture and soiling.

1.5 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 – Project Management and Coordination.

1.6 WARRANTY

A. Provide warrantees as indicated, and where not indicated provide manufacturers standard warrantees.

B. Warrant the work specified herein for one (1) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

PART 2 - PRODUCTS

3.1 SHOP EQUIPMENT AND MANUFACTURERS

A. Plasma Cutter (CFCI):
1. Designation on Drawings: MPC.
2. Basis of Design: Torchmate 4400 as manufactured by Lincoln Electric.
3. Number/Location: As shown on drawings.
4. Dimensions: 74 inches by 67 inches by 63 inches.
5. Machine Weight: 1322 lbs.
6. Tool Capacity: Two (2).
7. Water Capacity: 60 gallons.
8. Material Capacity: 1 inch mild steel.

B. Welding Booth Assembly:
1. Designation on Drawings: W-BT.
2. Basis of Design: WB-1054 as manufactured by Diversitech or Architect approved equal.
3. Size 5 feet W by 4 feet D by 7 feet – 6 inches H.
4. Material:12 ga. Steel.
5. Finish: Powder Coat.
6. Color: Black.
7. Accessories:
   a. Welding Curtain Rod and Curtain (W-CT):
      1) Basis of Design: FD-WB-ROD5 as manufactured by Fumedog.
      2) 5 feet wide by 20 inches D fixed rear shelf.
   b. Adjustable feet for leveling.
   c. Pole-Mounted swing arm for vertical, horizontal, and overhead welds.
   d. Fume Extractor:
      1) Basis of Design: 15320 Telescopic Welding Fume Arm with Internal support as manufactured by Monoxivent or Architect approved equal.
   e. LED adjustable booth light with local light switch.
   f. Adjustable swing arm at table surface to attach the coupons for the vertical, horizontal, and overhead welds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where equipment is to be installed to ensure areas are ready to receive equipment installation.

B. Ensure that proper utilities are in place. Confirm all power supplies are adequate for final equipment selections. Contractor responsible for all power supply changes needed to support final equipment selections.

3.2 INSTALLATION

A. Install, hook-up, and start-up all equipment in accordance with manufacturer's instructions.

3.3 ADJUSTING, DEMONSTRATING AND CLEANING

A. Adjust equipment for proper operation.

B. Instruct Owner’s personnel on proper operation, care, and maintenance of items.

C. Clean equipment of dirt, dust, fingerprints and markings detrimental to good appearance.

END OF SECTION 11 57 00

SECTION 11 61 43 – STAGE CURTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical data and specifications.

B. Shop Drawings: Show locations of tracks, height of curtains, mounting method and installation procedures.

C. Samples: Samples of fabrics showing manufacturer's full range of colors for Architect's selections.

D. Certificate: Furnish certification that the stage curtains are flameproof.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Specifications are based on named manufacturers. Other manufacturer's must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and Comply with Division 1 requirements regarding substitutions to be considered.

2.2 MATERIALS

A. Fabric:
   1. Front Setting: Valance, front curtain, and tormentor legs. "Memorable" velour finish fabric by K-M Mills, flameproofed, 25 ounce. Color selected by Architect from manufacturer's full line of available colors.

B. Curtain Tracks:
   1. Front Curtain Track: #400 Heavy Duty Straight Complete.
   2. Approved Manufacturer: H & H Specialties Inc., South El Monte, CA; (800) 221-9995, or Architect approved equal.

PART 3 - EXECUTION

3.1 FABRICATION AND INSTALLATION

A. Fabricate curtains using multiple widths of 54 inch wide velour without splicing within any panel.

B. Curtains shall be 50 percent fullness. Curtains shall be on top attached to 3-1/2 inch nine (9) lb. jute webbing with no less than two (2) rows of stitching. Pleats shall be 12 inches on center.

C. Curtains shall have #3 brass grommets with "S" hooks or tie line for attachment.

D. Curtain hem shall be five (5) inches with chain pocket and 2/9 chain. Outside hems shall be four (4) inches. Border hems shall be four (4) inches.

E. All seams shall be five (5) thread serge with all salvage material removed.

F. Center hem of front and concert curtains shall be one (1) foot.

G. Each Curtain shall have NFPA 701 tag permanently attached to the bottom of each curtain.

3.2 INSTALLATION

A. Verify dimensions and space conditions prior to fabrication.

B. All equipment shall be installed securely by hanging from structural members. Provide all necessary steel members, hangers and supports for the support chains, if required.

C. Curtains shall be finished properly in the best manner and method of the industry; and after hanging, adjust for smooth quiet operation, thoroughly brushed to remove all dust, loose threads, loose fabric lint, etc. Wrinkles shall be allowed to fall out naturally.

D. Remove from the site all rubbish and trash on completion of work and leave area in a clean, dust free condition.

END OF SECTION 11 61 43

SECTION 11 66 23 - GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Basketball equipment.
   2. Volleyball equipment.
   3. Safety pads.
   4. Accessories necessary for a complete installation.

1.3 DEFINITIONS

A. NFHS: National Federation of State High School Associations.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.5 SUBMITTALS

A. Product Data: Technical data for each type of product, including assembly, disassembly, and storage instructions for removable equipment and to indicate the performance, fabrication procedures, product variations, and accessories
   1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
   2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.
   1. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
   2. Include transport and storage accessories for removable equipment.

C. Samples: For the following products:
   1. Pad Fabric: Wall padding not less than 3 inches (76 mm) square, and corner and column samples not less than 3 inches (76 mm) long, with specified treatments applied. Mark face of material.

D. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.

E. Product Certificates: For each type of gymnasium equipment.

F. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

FIELD CONDITIONS

G. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

H. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.6 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

B. Coordinate layout and installation of overhead supported gymnasium equipment and suspension system components with other construction including light fixtures, HVAC equipment, fire suppression system components, and partition assemblies.
   1. WARRANTY
   2. Written warranty in which manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
      a. Failures include, but are not limited to, the following:
         1) Basketball backboard failures including glass breakage.
         2) Faulty operation of basketball backstops.
      b. Warranty Period: 25 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.
   1. Extruded Bars, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   2. Cast Aluminum: ASTM B 179.
   3. Flat Sheet: ASTM B 209 (ASTM B 209M).

B. Steel: Comply with the following:
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
   3. Steel Sheet: ASTM A 1011/A 1011M.

C. Support Cable: 1/4 inch (6 mm) diameter, 7x19 galvanized stranded steel wire rope with breaking strength of 7000 lb (3175 kg). Provide fittings complying with wire rope manufacturer's written instructions for size, number, and installation method.

D. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial quality, hot dip galvanized or zinc plated steel connectors and hangars.

E. General Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.

F. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.

G. Softwood Plywood: DOC PS 1, exterior.

H. Anchors, Fasteners, Fittings, and Hardware: Corrosion resistant or noncorrodible units; concealed; tamperproof, vandal and theft resistant design.

I. Grout: Nonshrink, nonmetallic, premixed, factory packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

2.2 BASKETBALL EQUIPMENT

A. Basis of Design Manufacturers: Sports Imports. Other manufacturers are subject to compliance with requirements:
   1. AALCO Manufacturing.
   2. ADP Lemco.
   3. Arizona Courtlines, Inc.
   4. Basketball Products International.
   5. Bison, Inc.
   6. Douglas Industries, Inc.
   7. Draper Inc.

8. IPI by Bison.
9. Jaypro Sports, LLC.
10. L. A. Steelcraft Products, Inc.
11. P. W. Athletic Mfg. Co.
12. Performance Sports Systems.
13. Porter Athletic Equipment Company.
14. Schelde North America.
15. Spalding Equipment.

B. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

C. Provide manufacturer's recommended connections complying with Section 05 50 00 of size and type required to transfer loads to building structure.

D. Overhead Supported Backstops:
   1. Basis of Desihn: Model 3107 as manufactured by Performance Sports Systems or architect approved equal.
   2. Folding Type: Provide manufacturer's standard assembly for backward folding backstop, with hardware and fittings to permit folding.
   3. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
      a. Dual Mast Frame: Welded and bolted or clamped with cross bracing.
      b. Finish: Polyester powder coat finish.
   4. Goal Height Adjuster: Adjustable from 8 to 10 feet (2.4 to 3 m) with gear drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
      a. Operation: Manual with detachable crank handle.
      b. Operation: Electric with integral gear-drive motor, with limit switches preset to goal heights and the following:
         1) Key switch control.
         2) One detachable electric control device(s).
         3) Wireless remote control.

E. Wall Supported Backstops:
   1. Basis of Desihn: Model 2350 as manufactured by Performance Sports Systems or architect approved equal.
   2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
      a. Dual Mast Frame: Welded and bolted or clamped with cross bracing.
      b. Finish: Polyester powder coat finish.
   3. Goal Height Adjuster: Adjustable from 8 to 10 feet (2.4 to 3 m) with gear drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
      a. Operation: Manual with detachable crank handle.
      b. Operation: Electric with integral gear-drive motor, with limit switches preset to goal heights and the following:
         1) Key switch control.
         2) One detachable electric control device(s).
         3) Wireless remote control.

F. Backstop Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000 lb (2722-kg) load capacity; one per folding backstop.

G. Winch: Hoist, consisting of heavy duty, fully enclosed worm gear; brake; cable drum; cable; and fittings, for mounting on wall with equipment mounting board; designed to move and hold backboard in any raised or lowered position.
   1. Operation: Manual winch with detachable hand crank.

2. Portable Winch Operator: One portable electric motor-drive device(s) including adaptor to fit crank mechanism.

H. Backstop Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory prewired motor controls, starter, gear reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
   3. Operator Mounting: Wall mounted board.
   4. Motor Electrical Characteristics:
      a. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
      b. Horsepower: 1 hp.
      c. Phase: Single.
   5. Remote Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary contact, three position, switch operated control with up, down, and off functions.
      a. Group Key Switch Control Stations: One switch per two backstops.
      b. Keys: Provide dual keys, one key for up and one for down per station.
      c. Switches, Ganged: Single faceplate with multiple switch cut outs for six switches operating 12 backstops.
      d. Control Station Enclosure: Provide prime-painted metal enclosure with key access with two sets of keys per enclosure.
      e. Radio Controls: Digital system consisting of code compatible universal coaxial receiver, one per backstop winch, and two portable multiple channel transmitters for operating up to nine backstops individually with up and down functions.
   6. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.

I. Basketball Backboards:
   1. Shape and Size:
      a. Rectangular, 72 inches by 48 inches (1800 mm by 1200 mm) width by height.
   2. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:
      a. Fiberglass: Not less than 1-1/2 inch (38 mm) thick, composite backboard consisting of not less than two 3/16 inch (5 mm) thick, molded fiberglass panels laminated together over faces and edges encapsulating a 3/4 inch (19 mm) honeycomb core, reinforced at goal and backboard mountings, or a wood panel product core; with threaded inserts or embedded anchors for mounting backboard corners to support framing at standard mounting centers.
      b. Glass: Not less than 1/2 inch (13 mm) thick, transparent tempered glass complying with ASTM C 1048 Kind FT (fully tempered) and with impact testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing.
         1) Provide glass with impact absorbing resilient rubber or PVC gasket around perimeter in a fully welded, brushed natural finish, extruded aluminum frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backboard support framing.
         2) Standard Mount: Provide steel corner reinforcement with mounting slots for mounting backboard frame to backstop at standard mounting centers. Provide center strut frame reinforcement.
         3) Direct Mount: Designed for mounting backboard frame to center mast of backstop to maximize relief of stresses on backboard frame and glass.

4) Rim Restraining Device: Complying with NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.

3. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced rules.

J. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern 5 inches (127 mm) o.c. horizontally and vertically for goal attachment.
1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.
2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.

K. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
1. Single Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced rules.
2. Type: Movable, breakaway design with breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
3. Breakaway Characteristics: Positive lock movable breakaway design, with breakaway mechanism including preset pressure release, set to release at 230 lb (105 kg) load, and automatic reset. Provide movable ring with rebound characteristics identical to those of fixed, nonmovable ring.

L. Basketball Nets: 12 loop mesh net, between 15 inches and 18 inches (380 mm to 460 mm) long, sized to fit rim diameter:
1. Cord: Made from white nylon.
2. Competition Cord: Antiwhip, made from white nylon cord not less than 120 gm thread and not more than 144 gm thread.

M. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports required by referenced rules.
1. Attachment: Peel and stick tape.
2. Color: Selected by Architect.

2.3 VOLLEYBALL EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis of Design Manufacturers: Sports Imports. Other manufacturers are subject to compliance with requirements, provide products by one of the following:
1. AALCO Manufacturing.
2. ADP Lemco.
3. American Athletic, Inc.
4. Arizona Courtlines, Inc.
5. Bison, Inc.
6. Douglas Industries, Inc.
7. Draper Inc.
8. IPI by Bison.
9. Jaypro Sports, LLC.
10. L. A. Steelcraft Products, Inc.
11. P. W. Athletic Mfg. Co.
12. Performance Sports Systems.
13. Porter Athletic Equipment Company.
14. Schelde North America.

15. Spalding Equipment.

C. Floor Insert: Brass floor plate; and Sports Imports Floor sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, not less than required to securely anchor pipe sleeve indicated; with anchors designed for securing floor insert to floor substrate indicated;quantity as indicated.
   1. Basis of Design: Model KA23 as manufac
   2. Floor Plate: Self locking, hinged access cover, designed to be flush with adjacent flooring. Provide one tool(s) for unlocking access covers.
   3. Floor Plate: Self locking, hinged access cover, recessed to accept finish flooring matching and designed to be level with adjacent flooring. Provide one tool(s) for unlocking access covers.
   4. Floor Plate: Lockable swivel access cover, designed for use with floating wood floors and to be flush with adjacent flooring. Provide two tool(s) for unlocking access covers.

D. Post Standards: Removable, paired volleyball post standards and a center post standard for multicourt play as indicated. Fixed height. Designed for easy removal from permanently placed floor insert supports. Fabricated from carbon pipe or tubing, with nonmarking plastic or rubber end cap or floor bumper to protect permanent flooring. Finished with factory applied, polyester powder coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness or plated metal finish.
   1. Basis of Design: Model SI as manufactured by Sports Imports.
   2. Nominal Pipe or Tubing Diameter: 4 inch (102 mm) OD at base.
   3. Net Height Adjuster: Track or rail system and lock mechanism designed for infinite height adjustment, complete with fittings; designed for positioning net at heights indicated.
   4. Telescopic and Net Height Adjuster System: Provide infinitely adjustable system consisting of screw rod, gear, and crank or constant tension spring and pulley assist and] [incrementally adjustable system with predrilled holes and pin locking device, telescopic post, and fittings for holding net at selected height; designed for height adjustment of post standard to position net at heights indicated.
   5. Height Markers: Clearly marked at regulation play heights for middle school.

E. Net: 32 feet (9.75 m) long; two per every center post standard;
   1. Basis of Design: Model HM50 as manufactured by Spors Imports.
   2. Width and Mesh: 36 inches (910 mm) with 4-1/2 inch (114 mm) square mesh made of black polyester string.
      a. Hem Band Edges: White, 2 inch (50 mm) wide top binding; black, 1 inch (25 mm) wide bottom and side bindings; tie offs at top and bottom of each side end of net; and 1/4 inch (6 mm) diameter rope, at least 42 feet (12.8 m) long, threaded through top hem of binding.
   3. Width and Mesh: Competition volleyball net, 36 inches (910 mm) with 4 inch (102 mm) square knotless mesh made of black nylon string.
      a. Hem Band Edges: White, not less than 2 inch (50 mm) wide top, bottom, and side bindings; tie offs at top, bottom, and midpoint of each side end of net] [not less than 1 inch (25 mm) wide tension straps at top, bottom, and midpoint of each side end of net; end sleeves for dowels; and lines with linkage fittings threaded through top and bottom hems of binding. Provide lengths of lines and linkage fittings as required to properly connect to and set up net for post standard spacing indicated on Drawings.
         1) Top Line: Not less than 1/4 inch (6 mm) diameter rope.
         2) Bottom Line: Not less than 1/4 inch (6 mm) diameter rope.
   4. Dowels: Not less than 1/2 inch (13 mm) diameter fiberglass or 1 inch (25 mm) diameter wood. Provide two dowels per net threaded through each side hem sleeve for straightening net side edges.
   5. Net Antennas: 3/8 inch (9.5 mm) diameter, high tensile strength, extruded fiberglass or plastic rods, 72 inches (1800 mm) long, extending above top hem band of net, with

alternating white and red bands according to competition rules. Provide two antennas per net.
a. Basis of Design: Model NA2 as manufactured by Sports Imports.
b. Clamps: Designed to secure antenna to top and bottom of net.

6. Boundary Tape Markers: 2 inch (50 mm) wide white strip with sleeve for securing net antenna, secured to net top and bottom with hook and loop attachment. Provide two tape markers per net for marking court boundaries.
7. Upright:
a. Basis of Design: Sl1 as manufactured by Sports Imports.

F. Net Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip worm gear type winch with cable length and fittings for connecting to net lines, positive release mechanism, and permanently fixed handle. Mount net tensioner on post standard at side away from court.] Provide end post with post top pulley. Provide opposing post with welded-steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.
1. Basis of Design: Model HDNR-B as manufactured by Sports Imports.

G. Bottom Net Lock Tightener: Provide quick release type tension strap; a spring loaded, self locking tensioner; a turnbuckle; a pulley; or other device and linkage fittings designed to quickly and easily tighten bottom line or net.

H. Judges' Stands: Provide adjustable height units designed to be freestanding, folding for storage with wheels for transporting Fabricate welded steel tubing units with finish and color to match post standards.
1. Basis of Design: Model PS1 as manufactured by Sports Imports.
a. Judges Stand Padding:
1) Basis of Design: Model PSP1 as manufactured by Sports Imports.

I. Safety Pads: Comply with NCAA and NFHS requirements. Provide pads consisting of not less than 1-1/4 inch (32 mm) thick, multiple impact resistant crosslinked or closed cell polyethylene foam filler covered by puncture and tear resistant fabric cover not less than 14 oz./sq. yd. (475 g/sq. m) nylon reinforced PVC; with fire test response characteristics indicated , and lined with fire retardant liner. Provide pads with hook and loop closure or attachments for the following components:
1. Basis of Design: Model FP1 manufactured by Sports Imports.
2. Post Standards: Wraparound style, designed to totally enclose each standard to a height of not less than 72 inches (1800 mm); one per post.
3. Net Lines: Four per net minimum or as indicated on the drawings.
4. Judges' Stands: Designed to totally enclose each unit.
5. Fabric Cover Flame Resistance Ratings: Complies with NFPA 701.
6. Fabric Color: Selected by Architect.
7. Graphics: Custom graphics as indicated.

J. Post Standard Transporter: Wheeled unit designed for transporting a single post.

K. Post Pad:
1. Basis of Design: FP1 as manufactured by Sports Imports.

L. Wall Storage Rack: Unit designed for mounting on walls and for storing post standards in vertical position with retaining arms, fittings for padlock, and mounting hardware; number of units as required to provide storage for specified equipment.
1. Basis of Design:
a. Model WR10 as manufactured by Sports Imports.

M. Storage Cart: Wheeled unit designed for transporting and storing volleyball equipment and passing through 36 inch (910 mm) wide door openings. Fabricate welded steel tubing units with heavy duty casters, including no fewer than two swivel casters. Fabricate wheels from materials that do not damage or mark floors; number of units as required to provide transport and storage for specified equipment.

1. Basis of Design:
    a. Model DU22 manufactured by Sports Imports

2.4 SAFETY PADS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. AALCO Manufacturing.
    2. ADP Lemco.
    3. American Athletic, Inc.
    4. Bison, Inc.
    5. Draper Inc.
    6. IPI by Bison.
    7. Jaypro Sports, LLC.
    8. Performance Sports Systems.
    9. Porter Athletic Equipment Company.
    10. Spalding Equipment.

B. Safety Pad Surface Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
    1. Flame Spread Index: 25 or less.
    2. Smoke Developed Index: 450 or less.

C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture and tear resistant, PVC coated polyester or nylon reinforced PVC fabric, not less than 14 oz./sq. yd (475 g/sq. m) and treated with fungicide for mildew resistance; with surface burning characteristics indicated, and lined with fire retardant liner.

D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
    1. Backer Board: Not less than 3/8 inch (9.5 mm) thick fire retardant treated plywood according to AWPA U1, UCFA Fire Retardant Interior.
    2. Fire Resistive Fill: Multiple impact resistant foam not less than 1-1/2 inch (38 mm) thick, fire resistive neoprene; 6.0 lb/cu. ft. (96 kg/cu. m) density.
    3. Size: Each panel section, 24 inches (600 mm) wide by not less than 72 inches (1800 mm) long.
    4. Number of Modular Panel Sections: As indicated.
    5. Installation Method: Concealed mounting Z clips.
    6. Fabric Covering Color(s): Selected by Architect for two color(s).
    7. Graphics: Custom graphics as indicated.

E. Cut out Trim: Provide flanged cut out trim kits for fitting pads around switches, receptacles, and other obstructions.
    1. Color: Architect to select color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
    1. Verify critical dimensions.
    2. Examine supporting structure, subgrades, subfloors, and footings below finished floor.
    3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
   1. Floor Insert Location: Coordinate location with application of game lines and markers , and core drill floor for inserts after game lines are applied.
   2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and floor-plate type.
   3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs and Footings. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Safety Pads: Mount with bottom edge at 4 inches (102 mm) dimension indicated on Drawings above finished floor.

F. Cut out Trim: Limit cuts in face of padding from trim unit's corner to corner outside dimensions. Install with ends of cuts concealed behind trim flange.

G. Anchoring to In Place Construction: Use anchors and fasteners where necessary to secure built in and permanently placed gymnasium equipment to structural support and to properly transfer load to in place construction.

H. Connections: Connect electric operators to building electrical system.

I. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by Architect and Owner, and store units in location indicated on Drawings.

3.3 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.4 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 11 66 23

SECTION 11 66 43 - INDOOR SCOREBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes
   1. One-Sided Combination Basketball & Volleyball Wrestling scoreboards

B. Responsibility of Coordination: Coordinate the work specified herein with the work specified in other sections including electrical requirements in Division 26.

C. Related Work
   1. Section 05 50 00 – Misc. Metal Fabrications: Steel shapes required for those scoreboards requiring framing, posts, or other steel support either from ground, attachment to structures.
   2. Division 26 - Electrical: Electrical requirements.
   3. All Sections regarding work to which scoreboards are attached.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.
   2. Manufacturer's installation instructions.

B. Shop Drawings: Indicate size, material, and finish. Show locations and install procedures. Include details of joints, attachments, and clearances.

C. Samples: Submit full range of colors, lettering styles, and finishes available for Architect's selection.

1.4 WARRANTY

A. Warrant the work specified herein as follows:
   1. Scoreboards shall be guaranteed for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.
   2. LED digits shall be guaranteed for ten (10) years against defects in materials.

B. Defects shall include, but not be limited to, the following:
   1. Loose or missing parts
   2. Severe deterioration of finish
   3. Faulty operation, including, but not limited to burned out LED lamps.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer's listed below who produce equivalent products to those specified are approved for use on the Project with Architect's approval. Manufacturers other than those listed must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
   1. Daktronics, Inc., Brookings, South Dakota
   2. Nevco Scoreboard Co., Greenville, Illinois;
   3. The Spectrum Corporation, Houston, Texas.
   4. Sportable Scoreboards, Murray, Kentucky.
   5. Trans-Lux Fair-Play, DesMoines, Iowa.

B. Basis of Design Product: Model 5242T-C3 Basketball Scoreboard manufactured by Spectrum, Inc., or Architect approved equal of approved manufacturers.

2.2 BASKETBALL & VOLLEYBALL SCOREBOARDS

A. Features:
   1. Home and Visitor score shall be incremented by one (1) from 0 to 199. Score may also be instantly cleared and reset by keypad entry to any score 0 to 199.
   2. Clock shall display time remaining up to 99:59. Clock shall be capable of counting up or down, and clock may be instantly reset to any desired time when clock is turned off.
   3. Quarters, 1-4, shall be displayed using a numeral lampbank.
   4. Double Bonus shot indicators for each team.
   5. Possession indicators for each team.
   6. Face-Mounted Horn shall sound manually when clock is turned off can sound automatically at end of period.
   7. Automatic substitution feature shall allow the operator to program the horn to sound automatically the next time the clock is turned off thus altering officials of substitution.
   8. Time-out timer shall display time remaining in the time-out. A very short horn blast shall warn of there being 15 seconds remaining in the time-out. The control box speaker shall signal the end of the time-out.
   9. Fractional seconds feature shows to 1/100 of a second, the time left in a period.
   10. Player's number who just committed a foul and his number of fouls shall be instantly posted using a keypad number entry.
   11. Team fouls shall be displayed from 0 to 99 for both home and visiting teams.
   12. Automatic Quarter Reset sets up next quarter and advances period automatically.
   13. Bonus shall start automatically at the preprogrammed 5th or 7th team foul.
   14. Speaking controls "tell" the user how to get started.
   15. Lighted (LED) clock colon and decimal interact with the running time. Clock colons disappear and the decimal point turns on to indicate time under 1:00.

B. Dimensions: Scoreboard shall be eight (8) feet in length by six (6) feet in height by six (6) inches in depth and shall weigh 180 lbs. Clock and score numeral displays shall be 14 inches high. Period, Fouls (won), (bout), Player number (game), (weight) numeral displays shall be ten (10) inches high.

C. Construction: Scoreboard face and scoreboard cabinet shall be made of 0.080 inch thick aluminum with premium urethane finish. Colors shall be as selected by Architect from manufacturer's standard color chart.

D. LED Digits (Light Emitting Diode): Digits shall utilize superbright LED lamps to form 14 inch amber Score digits and 14 inch red Clock digits. Bonus indicators are red LED, Possession indicators, colon and decimal are amber LED. Digits and indicators average 100,000 hours of lamp life (11 years at 24 hours per day) and provide a maintenance-free, energy efficient alternative to incandescent light bulbs. LED digits are covered with 1/8 inch Lexan shields to protect and absorb ball impacts.

E. Components: All electronic components shall be solid state. Component module shall be accessible from the front of the scoreboard.

F. Console: Operator's control console shall not require 120 VAC electrical power. The low voltage control console shall be housed in a protective, weather resistant carry case. A single ten (10) feet long, three (3) wire, low voltage control cable shall unplug and store inside the carrying case. Furnish two (2) control consoles with carrying cases.

G. Switches: Switching shall be accomplished by solid state membrane switching technology; each switch having a life of at least five (5) million operations. All switches shall be "splash proof" and environmentally sealed by a combination of layers of a velvetgrain, highly durable, polycarbonate and glossy polyester. All switches are defined by the 0.020 inch thick black velvetgrain polycarbonate "switch locator" overlay. The numeric keypad, clock on-off, and score switches shall give "tactile feedback" to recognition. Sound shall be emitted by all switches to let the operator know a switch has occurred. The clock on-off switch shall be environmentally sealed "bat type" toggle switch. Visual feedback shall be accomplished by LED indicators (green) for the clock and other selected switches (red.) This gives three (3) methods of feedback to the operator: Tactile (feel), Audio (sound), LED/Coding (sight).

H. Multi-Sport: The control panel switch functions shall be changed (depending on the type of scoreboard being used; i.e., basketball, volleyball, football, soccer, wrestling, etc.) by removing a single switch label insert from under the overlay and re-inserting the appropriate switch label insert. The insert shall slide in and out and is locked in place. (This allows a single control to operate multiple scoreboards of different sports). Each sport has a single switch label insert.

I. Electrical: Scoreboard shall require not more than 2.5 amperes at 120 VAC, 60 Hz.

J. Number/Location: Provide one (1) basketball scoreboard in the Auxiliary Gymnasium opposite bleachers in location shown on drawings.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper scoreboard installation include, but not limited to, the following:
   1. 2.4 GHz spread spectrum radio system with frequency hopping technology and 64 non-interfering channels; system includes a transmitter installed inside the console and a receiver installed inside the scoreboards.
   2. Hard carrying case.
   3. Battery pack.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install specified units in accordance with manufacturer's printed instructions. Erect units plumb and level, with power supply coordinated with the electrical Division.

B. Install each scoreboard on framing and supports as indicated on drawings. Refer to Section 03 30 00, Cast-In-Place Concrete for concrete footings of scoreboard posts as shown or required. Refer to Section 05 50 00, Miscellaneous Metals for steel items incidental to framing and support of scoreboards as shown or required.

C. Adjust each scoreboard for proper function. Replace broken lamps, faulty control elements, and damaged parts.

D. Provide remote locations for additional controller hook-ups as indicated.

END OF SECTION 11 66 43

SECTION 11 73 11 - PATIENT LIFTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Patient lift equipment with powered operating system and overhead-supported tracks.

1.2 RELATED REQUIREMENTS

A. Section 09 51 00 - Acoustical Ceilings.

1.3 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. AISI S400 - North American Standard for Seismic Design of Cold-Formed Steel Structural Systems; 2015, with Supplement (2016).

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

F. ITS (DIR) - Directory of Listed Products; Current Edition.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. See Section 01 70 00 - Execution and Closeout Requirements for preinstallation meeting requirements.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets of operating system components, track system components, track depth, track maneuverability systems, slings, and accessories. Indicate dimensions, performance requirements, service requirements, materials, finishes, and options

C. Shop Drawings: Indicate dimensions, reflected ceiling plan track layouts, above-ceiling support requirements, attachment-to-support details, point loads, and power-supply connections.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.

D. Delegated Design Data:
   1. Shop drawings of overhead structural support system signed and sealed by a professional structural engineer.
   2. Calculations for loadings and stresses of cold-formed steel overhead structural support system, signed and sealed by a professional structural engineer.
   3. Details and calculations for factory-made framing connectors, signed and sealed by a professional structural engineer.

E. Test Reports: Factory tests for each type of equipment.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Operation Data: Include description of equipment operation and required adjusting and testing.

I. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Project Record Documents: Record actual locations of concealed utility connections and _____.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design overhead structural support system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package equipment to project site in protective packaging.

B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Patient Lifts:
1. EZ Way, Inc; CL650: www.ezlifts.com/#sle.
2. Liko, a Hill-Rom Company: www.hill-rom.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 OPERATING SYSTEM

A. Battery-operated patient lift mounted in track system to transfer patients along track system; capable of both powered and manual traverse movement.
1. Lifts per Charge: 120 lifts, nominal.
2. Lifting Speed: 0.91 inch/sec (2.3 cm/sec).
3. Features: Overload protection, dual pawl emergency brake system, and emergency down control.
4. Battery Charging Options: Continuous charging.
5. Motor-Track Trolley: Component of motor housing for integration with track system.
6. Hand-control remote control.
7. Lifting Strap: 2 inches (51 mm) wide; 94 inches (239 cm) spoolable length.
8. Spreader Bar: Spreader bar with four lifting points for sling attachment.

B. Electrical Components, Devices, and Accessories: Listed and labeled by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction and installed in compliance with NFPA 70, and marked for intended application.

2.3 TRACK SYSTEM

A. Description: Manufacturer's standard track systems capable of varying track configuration layouts:
1. Track Depth:

a. Standard Track: 2.31 inches wide by 2.66 inches high (58.70 mm wide by 67.74 mm high) ; 650 lbs (295 kgs) capacity.
b. Extra Tall Track: 2.31 inches wide by 5.34 inches high (58.70 mm wide by 143 mm high); 650 lbs (295 kgs) capacity.

2. Track Maneuverability Systems:
   a. Single Rail Track System; with 45-degree bend curved tracks and 650 lbs (295 kgs) capacity.
   b. Gantry Rail Track System; 650 lbs (295 kgs) capacity.
   c. Refer to drawings for layout.

B. Materials:
   1. Track: Extruded aluminum, ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

C. Finish: Powder coated aluminum.

D. Color: Bright white.

2.4 OVERHEAD STRUCTURAL SUPPORT SYSTEM

A. Metal Channel (Strut) Framing Systems:
   1. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Thomas & Betts Corporation: www.tnb.com/#sle.
      c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
      e. Source Limitations: Provide channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

B. Description:
   1. Structural, overhead-supported, cold-formed framing system for supporting patient lift equipment track system.
   2. Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of patient lift overhead support system.
   3. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for a complete installation that supports the associated patient lift track and operating systems.

C. Design Criteria: Provide cold-formed steel overhead structural support system.
   1. Structural Performance: Cold-formed structural members and systems capable of withstanding design loads, and in compliance with design reference standards.
   2. Design Reference Standards: Provide system components in compliance with AISI S100 and AISI S240.
      a. Provide system components in compliance with seismic requirements of AISI S400
   3. Design Loads: Provide system components in compliance with applicable codes.

D. Provide classified products, listed and labeled as suitable for intended purpose, where applicable.

E. Channel Materials:
   1. Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm) minimum; but not less than thickness required to meet performance requirements.
   2. Size: 1-5/8 inch (41 mm) wide13/16 inch (20.6 mm) by 13/16 inch (20.6 mm) high minimum, but not less than size required to meet performance requirements.
   3. Corrosion Protection Coating Designation: CP 60 in compliance with AISI S240.

2.5 ACCESSORIES

A. Slings: Provide Manufacturer's standard sling with load rating equal to or greater than load rating of lift.

B. Installation Accessories: Provide necessary accessories and closure trim as required for complete installation.

C. Fasteners: Provide Manufacturer's standard inserts, anchors, bolts, rivets, and screws appropriate for project conditions; corrosion-resistant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions, with installer present, for compliance with requirements of supporting structural members, installation tolerances, and other conditions that may impact performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions and approved shop drawings.

B. Set components plumb, level, and rigid.

C. Install anchors in accordance with anchor manufacturer's installation guidelines.

D. Interface With Other Work: Use pop rivets or screws to attach L-shaped perimeter moldings of ceiling to lift equipment track.

E. Track System Interface with Finish Ceiling: Install track system relative to finish ceiling for semi-recessed track installation.
   1. Coordinate track system interface with components of Section 09 51 00 - Acoustical Ceilings.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.4 ADJUSTING

A. Adjust operating equipment for smooth and efficient operation throughout full operating cycle.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of equipment to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

E. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.
   5. Location: Owner's offsite classroom facilities may be used.

F. Final Acceptance: Remove labels, fingerprints; clean surfaces. Repair any marred or damaged surfaces that effect appearance in manner not acceptable to Owner. Replace any parts that cannot be repaired in such a manner.

3.6 PROTECTION

A. Protect installed equipment from subsequent construction operations.

3.7 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

3.8 BASIS OF DESIGN

A. Patient Lift Equipment:
   1. Basis of Design: Likorall Overhead Lift - Model 243manufactured by Liko, Inc. .
   2. Location: Refer to Drawings.
   3. Owner/Contractor Responsibility: CFCI._____

END OF SECTION 11 73 11

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SECTION 11 95 13 - KILNS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Kiln.
   2. Kiln Vent.
   3. Kiln Drying Cabinet.

B. Related Sections
   1. Division 26 – Electrical Sections.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.
   3. Manufacturer's operation and maintenance data, as applicable.

B. Shop Drawings: Show sizes, locations and installation details. Include utility (electrical, water, gas) requirements.

C. Samples: Color charts showing manufacturer's full range of colors.

1.4 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00 - Project Management and Coordination.

1.5 COORDINATION

A. Coordinate Work of this Section with Work of other sections in which items are to be installed.

1.6 WARRANTY

A. Manufacturer's standard warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Specifications are based on products of manufacturers named as the Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Kilns and Drying Cabinet:
      a. American Art Clay Co, Inc. (AMACO): www.amaco.com/#sle.
      b. Paragon Industries, L.P.: paragonweb.com/#sle.
      c. Skutt Ceramic Products: skutt.com/#sle.
   2. Kiln Vent:
      a. Vent-A-Kiln Corporation: ventakiln.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 MATERIALS

A. Kiln:
   1. Type: Automatic Firing.
   2. Temperature: Cone 10, 2350 degrees F.
   3. Electrical Requirements: 208 volts, 51.5 amps, 3-phase.

4. Chamber Dimensions: 28-1/8 inch opening, 31 inches deep, 11.57 cubic feet.
5. Accessories:
   a. Standard Accessories.
   b. Stand.
   c. Shelves and posts.
   d. Furniture Kit.
   e. Instruction manual.
6. Approved Product: Model No. KM-1231-3PK manufactured by Skutt Ceramic Products or Architect approved equal by Paragon Industries, L.P. or AMACO.

B. Kiln Vent:
1. Type: Wall mounted, down draft, negative pressure with flexible exhaust hose and exterior louver.
2. Power Requirements: 120 volt, 1.4 amps, Single Phase..
3. Dimensions: 36 inches W by 19 inches D by 83 inches H.
4. Lockable.
5. Duct: 3” diameter, 8” length - flexible aluminum.
6. Location: One (1) at each kiln.
7. Approved Product: EnviroVent 2 Downdraft Ventilation System with “Envirolink” manufactured by Skutt Ceramic Products; or Architect approved equal by Paragon Industries, L.P. or AMACO.

C. Drying Cabinet:
1. Basis of Design: Large Drying Cabinet Model #9200 as manufactured by Skutt.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utility (electrical, water, and gas) requirements, where applicable, are installed and ready for connection.

B. Verify items fastened to walls have proper blocking or support items installed.

C. Verify locations for items are ready for their installation.

3.2 INSTALLATION

A. Install all items in accordance with manufacturer's printed instructions in locations shown on drawings or otherwise indicated.

3.3 CLEANING AND ADJUSTING

A. Make final adjustment after installation and clean all backstop support piping of dirt and other substances which may affect final finish.

B. Clean all items of dirt and foreign matter which may affect appearance and operation.

C. Adjust items for proper operation.

D. Instruct Owner’s personnel on proper operation and maintenance of items.

END OF SECTION 11 95 13

SECTION 12 11 00 - DIGITALLY-PRINTED VINYL WALL GRAPHICS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Very large scale vinyl wall graphics (murals) digitally printed on self-adhesive vinyl graphics film from electronic graphic image files furnished by the Architect, adhered to gypsum board surfaces with a Level 5 skim coated, smooth painted finish.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Installation drawings: Indicate configuration and dimensions of substrate(s) including (if applicable) penetrating and protruding elements; vinyl mural panels; seam locations; details of installation; and related and adjacent work. Note field-measured dimensions.

B. Product Data:
   1. Manufacturers' specifications for vinyl film medium, inks and laminating film, and other data sufficient to demonstrate compliance with specified requirements
   2. Manufacturer’s written preparation, installation, and cleaning and maintenance instructions and recommendations

C. Samples:
   1. Color Approval Proof:
      a. Full color laminated print produced with the same equipment that will be used for the actual vinyl wall graphics panels, using the specified resolution, ink sets, vinyl film printing medium and clear protective laminating film, in a size proportional to the finished mural, with the lesser dimension approximately equal to the width of the vinyl film medium.
      b. Make adjustments, reprint and resubmit as necessary to obtain Architect's approval.

D. Certificates: Submit written certification, on graphics provider firm's letterhead, that products and installation comply with specified requirements.

1.4 ENVIRONMENTAL CONDITIONS

A. Maintain room and substrate temperature and humidity within the ranges recommended by the graphic film manufacturer at least 48 hours prior to, during, and after installation, until Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store products as recommended by the manufacturer(s), in graphics provider's labeled protective packaging. Protect from damage and deterioration.

1.6 WARRANTY

A. Graphics provider shall provide a 10-year material and labor warranty against fading, edge lifting, peeling, discoloration, delamination of the overlaminate from the vinyl graphics film, and delamination of the vinyl film from the painted Level 5 skim-coated smooth-painted gypsum board substrate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS, MANUFACTURERS AND GRAPHICS PROVIDERS

A. Specifications are based on products, manufacturers and graphics providers named herein or listed as the Basis of Design. Products of manufacturers listed which meet or exceed specifications are approved for use on the Project. Other manufacturers and graphics providers must have a minimum of five years experience supplying (and for graphics providers, installing) products meeting or exceeding the specifications, and comply with requirements of Section 01 25 13 Product Substitution Procedures to be considered.

2.2 GRAPHICS PROVIDER

A. Basis of Design: Riot Creative Imaging division of ARC (Dana LaPointe), 6300 Gulfton, Houston, TX 77081; 713-830-3933; dana.lapointe@riotcolor.com; www.riotcolor.com

B. Single-source Responsibility: Graphics Provider shall be solely responsible for processing, production and installation, whether installation is performed by its own personnel or by its approved installation contractor.

2.3 EQUIPMENT

A. Basis of Design Printer: HP 3000 grand format inkjet printer with HP 881 Latex Printheads; 54 inch wide media capacity; 600 dpi minimum resolution, or equivalent equipment acceptable to the Architect and compatible with the specified (or approved substitution) inks and media.

B. Laminator: Compatible with the specified (or approved substitution) vinyl film media, inks and overlaminate.

2.4 MATERIALS

A. Metal Graphic (VG3):
   1. Type: Custom metal graphic.
   2. Design: Refer to Drawings.

B. Basis of Design for VWC-Drywall Application:
   1. Protective Laminated Film: ClearShield Wall Armor film. Category V Type II.
      a. Colorfastness: Greater than or equal to 200h.
      b. Washability: Greater than or equal to 100 cycles.
      c. Scrubability: Greater than or equal to 300 cycles.
      d. Abrasion Resistance: Greater than or equal to 300 cycles.
      e. Cracking, Drying: Good.
      f. Stain Resistance to Reagents: 4.
      g. Flame Spread: Less than or equal to 25.

   2. Inks: HP™ 881 Latex Inks; low-VOC, UV-resistant, water-soluble, latex-based, odorless pigmented inks.

a. Curing: Heat and infrared cured
b. VOCs: Less than 294 g/L
c. Hazardous Air Pollutants (HAPs): None.
d. Hazard Warning Labels: None (cautionary only; no "R" phrases).
e. Flammability/ combustibility: Nonflammable; noncombustible; FP > 93.3C
f.

3. Vinyl Wall Covering: Dreamscape Suede.
   a. Description: Commercial grade vinyl printable vinyl wallcovering media for modern wide format inkjet printers.
   b. Construction: Embossed vinyl face with laminated fabric backing.
   c. Backing: Poly-cotton woven or polyester/pulp non-woven.
   d. Type Properties: Passes all criterion for WA 101, Type II.
   e. Thickness: 0.017 in.

4. Accessory products, tools, and equipment: Recommended by, or acceptable to, the manufacturers of the materials with which they are used.

C. Basis of Design for CMU Application:
1. Vinyl Graphics Film: 3M™ "IJ180Cv3-10 Controltac™ Graphic Film" cast vinyl film suitable for inkjet printing. Calendared films are not acceptable.
   a. Film Thickness: 0.05 mm (2 mil, 0.002 inch)
   b. Surface: Smooth, white, opaque and glossy.
   c. Applied shrinkage: < 0.1 mm per FTM 14.
   d. Adhesive: Factory-applied 3M "Comply™ v3" solvent acrylic pressure-sensitive repositionable adhesive with air release channels, protected by double-sided polyethylene coated paper, for dry application only, for permanent, non-removable installation.
      1) Adhesion: Approximately 18 N/25 mm per FTM 1 (180 degree peel, glass, 24h, 23 degrees C, 50 percent RH)

2. Inks: HP™ 881 Latex Inks; low-VOC, UV-resistant, water-soluble, latex-based, odorless pigmented inks.
   a. Curing: Heat and infrared cured
   b. VOCs: Less than 294 g/L
   c. Hazardous Air Pollutants (HAPs): None.
   d. Hazard Warning Labels: None (cautionary only; no "R" phrases).
   e. Flammability/ combustibility: Nonflammable; noncombustible; FP > 93.3C

3. Protective Laminating Film: 3M™ "Envision™ Luster Wrap Overlaminate 8548L" cast film. Calendared films are not acceptable.
   a. Luster high performance non-PVC film
   b. Exceptional conformability and lifting resistance
   c. Less prone to scratching
   d. Superior UV and acid dew protection
   e. Longer term vertical durability
   f. Horizontal warranty

2.4 PROCESSING AND PRODUCTION

A. Lay out each mural image in full-height vertical panels without horizontal seams. Allow overlap at vertical seams for accurate alignment and trimming. Unless otherwise specifically authorized by the Architect, lay out so panels are equal in width and arranged symmetrically. In no case shall a panel be less than one-half the vinyl media width.

B. For uniform appearance, produce all panels using vinyl film media, inks, and laminating film that are each sourced from a single manufacturing lot or production run.

C. Each panel shall be free from skipped print head scan lines, ink deposition irregularities, physical defects and other noticeable flaws. If flaws are found, reprint as many panels as necessary for flawless appearance and consistent color match between all panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. With the installer, examine the conditions affecting work of this section, including but not necessarily limited to substrate surface smoothness, cleanliness, and uniformity; adjacent materials; and temperature and humidity.
   1. Confirm that substrate surfaces are properly finished, smooth, and clean, and are free of contaminants, texture, roughness, voids, protrusions and other surface irregularities that could impair adhesion or telegraph through the applied film.
   2. Report unsatisfactory conditions to the Architect in writing.
   3. Do not proceed with installation until unsatisfactory conditions have been corrected. Commencement of installation shall be deemed to be acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Acclimatize printed vinyl film and other materials to the environment where they will be installed for at least 24 hours prior to commencement of installation, or for a longer period if recommended by the manufacturer.

B. Prior to installation, re-inspect mural panels closely for skipped print head scan lines, ink deposition irregularities, physical defects and other noticeable flaws. If flaws are found, reprint and replace as many panels as necessary for flawless appearance and consistent color match between all panels.

3.3 INSTALLATION

A. Digitally-Printed Vinyl Murals:
   1. Installation shall be performed only by trained, experienced personnel approved by the graphics provider.
   2. Install in accordance with manufacturer’s instructions and reviewed submittals.
   3. Install in location(s) shown on drawings
   4. Seams: Hairline, with overlapped, razor-cut butt joints. Visually align adjacent panels for accurate registration with no visible gaps, offsets or misalignments.
   5. Install without bubbles, wrinkles, gaps, fish mouths and other surface and seam irregularities for a smooth, uniform appearance.

3.4 CLEANING AND PROTECTION

A. Protect installed work from deterioration and other damage as recommended by the manufacturer until date of Substantial Completion.

B. If necessary and possible, clean or repair murals to restore to like-new condition following manufacturer's written instructions and recommendations.

C. Replace materials found to be defective or damaged, if it is not possible to clean or restore them to like-new condition.

D. Clean and repair damaged adjacent surfaces and other work damaged by the work of this section. If damage cannot be cleaned or repaired to the equivalent of new condition (or for existing materials, their condition prior to damage from construction), replace damaged materials with new undamaged materials.

END OF SECTION 12 11 00

END OF NARRATIVE

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SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Horizontal slat louver blinds.
   2. Operating hardware.
   3. Motor controls for motorized blinds.

B. Related Sections:
   1. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
   2. Section 10 71 13 - Exterior Sun Control Devices: Exterior horizontal louver blinds.

1.3 REFERENCE STANDARDS

A. NFPA 1 - Fire Code; 2024.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. Refer to Section 06 10 00 - Rough Carpentry.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data indicating [physical and dimensional characteristics; operating features.
   1. Motorized Blinds: Include power requirements and standard wiring diagrams.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
   1. Motorized Blinds: Include schematic system riser diagram indicating component interconnections, detailed sequence of operations describing system functions, and requirements for interface with other systems.

D. Samples: Submit two samples, 6-inch long illustrating slat materials and finish wand; type and color.

E. Manufacturer's Installation Instructions: Indicate [special procedures; perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Blind Assemblies: One of each size.
   3. Extra Slats: 20 of each type and size.
   4. Extra Lift Cords, Control Cords, and Wands: One of each type.

1.6 QUALITY ASSURANCE

A. Motorized Blinds: Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specification requirements, products by the listed manufacturers or fabricators may be submitted for use in the Work.
   1. Horizontal Louver Blinds:
      a. Draper, Inc; www.draperinc.com.
      b. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com.
      c. Levolor: www.levolor.com/commercial.
      d. Springs Window Fashions (SWF) contract, a division of Springs Window Fashions, LLC: www.swfcontract.com.

B. Substitutions: **[**Refer to Section 01 25 13 - Product Substitution Procedures**;** or Not permitted**]**.
   1. Manufacturers and fabricators not listed must have a minimum of 5 years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered. Submit as a substitution.

C. Source Limitations: Furnish blinds and associated controls produced by a single manufacturer and obtained from a single supplier.

2.2 BLINDS WITHOUT SIDE GUIDES

A. Basis of Design:
   1. Classics 1" Cordless Aluminum Blinds manufactured by SWFcontract.

B. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail complying with WCMA A100.1.

C. Manual Operation: Control of raising and lowering by cordless mechanism; blade angle adjustable by control wand.

D. Plastic Slats: PVC foam radiused slat corners.
   1. Width: 2 inch; 2-1/2 inch.
   2. Thickness: Manufacturer's standard.
   3. Color: As indicated on Drawings.
   4. Texture: Smooth.

E. Slat Support: Polymer cord ladder configuration.

F. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
   1. Height: As required.
   2. Color: Match slats.

G. Bottom Rail: Pre-finished, formed steel; aluminum with top side shaped to match slat curvature with end caps.
   1. Color: Match headrail.

H. Control Wand: Extruded hollow plastic square shape.
   1. Non-removable type.
   2. Length of window opening height less; or plus 3 inch.
   3. Color: As selected by the Architect.

I. Headrail Attachment: Wall brackets; Ceiling brackets.

J. Accessory Hardware: Type recommended by blind manufacturer.

2.3 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/8 inch.

C. Fabricate blinds to cover window frames completely.

D. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/4 inch between blinds located at window mullion centers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. Refer to Section 06 10 00 - Rough Carpentry.

3.2 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with concealed fasteners.

C. Place intermediate head supports at spacing recommended by the manufacturer.

3.3 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset from Level: 1/8 inch.

3.4 ADJUSTING

A. Adjust blinds for smooth operation.

B. Motorized Blinds:
   1. Set limit switches for uniform range of motion according to project requirements.
   2. Program control system parameters according to requirements of the Owner.

3.5 CLEANING

A. Clean blind surfaces just prior to occupancy.

B. Refer to Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION 12 21 13

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SECTION 12 24 00 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior manual roller shades.

B. Interior motorized roller shades.

C. Motor controls.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.3 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015 (Reapproved 2021)e1.

B. C2C (DIR) - C2C Certified Products Registry; Cradle to Cradle Products Innovation Institute; Current Edition.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

E. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

F. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

G. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

C. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.

E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

F. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Motorized Shades: Include finish selections for controls.

G. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.

H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

L. Maintenance contracts.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum 3 years of documented experience with shading systems of similar size and type.
   1. Manufacturer's authorized representative.
   2. Factory training and demonstrated experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 MOCK-UP

A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.
   1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
   2. Full-sized mock-up will become the property of the Owner to be used for spare parts.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.9 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Electric Motors: One year.
   3. Electronic Control Equipment: One year.
   4. Fabric: One year.
   5. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc Clutchshade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   3. Levolor: www.levolor.com/commercial/#sle.
   4. Lutron Electronics Co., Inc: www.lutron.com/#sle.
   5. MechoShade Systems LLC: www.mechoshade.com/#sle.
   6. Rollease Acmeda Contract: www.rolleaseacmedacontract.com/#sle.
   7. TimberBlindMetroShade: www.timberblinds.com/commercial-division/#sle.
   8. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com/#sle.
   9. Substitutions: See Section 01 60 00 - Product Requirements.

B. Interior Motorized Roller Shades, Motors and Motor Controls:
   1. Draper, Inc; Motorized FlexShade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural; RB500 Motorized Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   3. Levolor: www.levolor.com/commercial/#sle.
   4. Lutron Electronics Co., Inc; Contract Roller Motorized Roller Shades: www.lutron.com/#sle.
   5. MechoShade Systems LLC; UrbanShade Single Roller - Motorized: www.mechoshade.com/#sle.
   6. Rollease Acmeda Contract; Contract Series One Medium Fascia Roller Shade: www.rolleaseacmedacontract.com/#sle.
   7. TimberBlindMetroShade; SolarVue Motorized Roller Shade: www.timberblinds.com/commercial-division/#sle.
   8. SWFcontract, a division of Springs Window Fashions, LLC: www.swfcontract.com/#sle.
   9. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Interior Roller Shades - Basis of Design: Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   1. Description: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
      a. Drop Position: Regular roll.
      b. Mounting: Wall mounted.
      c. Size: As indicated on drawings.
      d. Fabric: As indicated under Shade Fabric article.
   2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Hardware Type: Universal brackets.
      b. Double Roller Mounting: Configured for light-filtering and room-darkening shades in one opening.
         1) Light-Filtering Fabric: Room-side of opening.
         2) Room-Darkening Fabric: Glass-side of opening.
   3. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.

4. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
    a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize double-sided adhesive tape.
    d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
5. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
    a. Style: Closed pocket; aluminum elliptical slat inside pocket with heat-sealed ends.
6. Manual Operation:
    a. Clutch Operator Location: As indicated on drawings.
    b. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
    c. Shade Lift Assistance: Manufacturer's standard spring device contained in the idler end of roller tube to reduce force required to lift shades; as required based on shade weight.
    d. Chain Retainer:
        1) Chain tensioning device complying with WCMA A100.1.
        2) Manufacturer's standard clip.
    e. Idler Assembly: Molded nylon with adjustable length idler pin or spring-loaded idler to facilitate easy installation and removal of shade for service.
7. Accessories:
    a. Light Gap Reduction Channels: Provide extruded aluminum channels to reduce light leakage at sides of shades.
    b. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to mounting end caps, without exposed fasteners; clear anodized finish.
    c. Exposed Headbox: Extruded aluminum, size as required to conceal shade mounting; clear anodized finish.
        1) Color: Black.
    d. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting shade hardware into ceiling. Provide removable closure panel to conceal underside of brackets and roller tubes.
    e. End Cap Covers: Match fascia or headbox finish.
    f. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

C. Interior Roller Shades - Basis of Design: Draper, Inc; Motorized FlexShade: www.draperinc.com/#sle.
1. Description: Double roller, motor-operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
    a. Drop Position: Regular roll.
    b. Mounting: Wall mounted.
    c. Size: As indicated on drawings.
    d. Fabric: As indicated under Shade Fabric article.
2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    a. Hardware Type: Universal brackets.
    b. Double Roller Mounting: Configured for light-filtering and room-darkening shades in one opening.
        1) Light-Filtering Fabric: Room-side of opening.
        2) Room-Darkening Fabric: Glass-side of opening.

3. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
4. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
    a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize double-sided adhesive tape.
    d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
5. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
    a. Style: Closed pocket; aluminum elliptical slat inside pocket with heat-sealed ends.
6. Shade Motor: Standard 120V AC motor, located as indicated on drawings.
7. Intelligent Intelliflex I/O Motor:
    a. Supports bidirectional network communication; power and communication distributed to network via network device connectors without requiring external power supplies.
    b. Supports sensor integration and event scheduling via sensor/schedule interface, interface with third-party control systems via A/V gateway, integration with building management systems via IP, and solar-tracking controls.
8. Intelligent RS485 Motor:
    a. Supports bidirectional network communication with individual unique address; capable of storing 16 configurable group addresses for group control.
    b. Capable of alignment within accuracy of plus/minus 0.8 inch (2 mm).
    c. Supports positioning from 0 to 100 percent in 0.5 percent increments and 16 customizable stop points.
9. Accessories:
    a. Light Gap Reduction Channels: Provide extruded aluminum channels to reduce light leakage at sides of shades.
    b. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to mounting end caps, without exposed fasteners; clear anodized finish.
    c. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting shade hardware into ceiling. Provide removable closure panel to conceal underside of brackets and roller tubes.
    d. Exposed Headbox: Extruded aluminum, size as required to conceal shade mounting; clear anodized finish.
        1) Color: Black.
    e. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.3 ROLLER SHADE FABRICATION

A. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

2.4 SHADE FABRIC

A. SB1: Window Shade Blackout Fabric.
    1. Basis of Design: SunBoc Series SB9000.
    2. Color: To be determined by the Architect from the full range of available selections.

B. SF1: Window Shade Light Screen Fabric.
    1. Basis of Design: SheerWeave Series SW2400.
    2. Color: To be determined by the Architect from the full range of available selections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.5 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

C. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

D. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.7 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.8 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, a proposal as an alternate to the base bid, a separate renewable maintenance contract for the service and maintenance of a motorized shade system for one year from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

END OF SECTION 12 24 00

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SECTION 12 35 53.19 – WOOD LABORATORY CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Wood casework.

B. Fume hoods.

C. Epoxy resin work surfaces.

D. Service fittings.

E. Accessory items as specified herein.

1.3 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Blocking within walls to adequately support casework.

B. Section 08 71 00 - Door Hardware: Refer for Owner's keying system for locks.

C. Section 09 65 13 - Resilient Tile Base: Furnishing and installing rubber base.

D. Section 12 35 50 - Educational Casework.

E. Division 22 - Mechanical:
   1. Furnishing and installation of piping, drainline, traps, final connections and setting of sinks and fixtures.
   2. Furnishing and installation of exhaust ductwork, transition(s), blowers and equipment, and final connection to fume hood(s).

F. Division 26 - Electrical: Furnishing and installation of electrical wiring, conduit and/or electrical items and final connections.

1.3 REFERENCES

A. American Disabilities Act (ADA)
   1. American Disabilities Act Design Guidelines (ADADG).

B. American National Standards Institute (ANSI)
   1. American National Standards Publications.

C. American Woodwork Institute
   1. Architectural Woodwork Quality Standards.

D. SEFA (Scientific Equipment and Furniture Association) standards.
   1. SEFA 1.2 – Fume Hoods.
   2. SEFA 2.3 – Installation of Scientific Laboratory Furniture and Equipment.
   3. SEFA 3 – Work Surface.
   4. SEFA 7 – Laboratory and Hospital Fixtures.
   5. SEFA 8 – Laboratory Furniture.

1.4 DEFINITIONS

A. Definitions of cabinet components by surface visibility:
   1. Exposed Surfaces:
      a. Surfaces visible when drawers and solid doors are closed.
      b. Surfaces visible behind clear glass doors.
      c. Interior surfaces of open units.
      d. Bottoms of cabinets 42 inches or more above finished floor.
      e. Tops of cabinets less than 78 inches above finished floor, or are visible from an upper floor or staircase after installation.
      f. Front edges of cabinet body members visible though a gap greater than 1/8 inch with doors and drawers closed.
      g. Surfaces visible when fixed appliances are installed.

   2. Semi-exposed Surfaces:
      a. Surfaces visible when doors are open.
      b. Bottoms of cabinets 30 inches - 42 inches above finished floor.
      c. All front edges of shelving behind doors.

   3. Concealed Surfaces:
      a. Surfaces not normally visible after installation.
      b. Bottoms of cabinets less than 30 inches above finished floor.
      c. Tops of cabinets over 78 inches above finished floor which are not visible from an upper level.
      d. Stretchers, blocking, components concealed by drawers.

1.5 SUBMITTALS

A. Manufacturer's Compliance Statement:
   1. Pre-qualified manufacturers whose name appears below under acceptable Manufacturers shall provide statement of compliance as scheduled by General Contractor; or
   2. Manufacturers requesting substitution of products shall submit statement of compliance at proposal time in accordance with Division 1 requirements for substitutions.

B. Shop Drawings: Provide large scale plans and elevations of casework, cross sections, rough-in and anchor placements, tolerances and clearances. Indicate relationship of units to windows, doors, surrounding walls and other building components.

C. Product Data: Submit manufacturer's catalog for reference. Include cabinet dimensions, configurations, construction details, joint details, attachment details, and rough-in details as required.

D. Product Samples to be submitted for approval (One (1) each):
   1. Worktop: Four (4) inch x four (4) inch sample of each material.

2. Finish: Three (3) inch x five (5) inch sample of each available standard stain color with finish for Architect's selection.
3. Provide an actual sample of a cabinet in the color and finish selected for Architect's approval. Approved cabinet color and finish will be basis for which all work will be judged. Approved sample cabinet may be used in the work. All cabinets shall match in color and finish to that of the approved sample and if found to vary in color, i.e., too light or too dark shall be refinished to match approved sample at no expense to Owner.
4. Hardware: Pulls, locks and hinges. Locks shall be keyed alike and masterkeyed to Owner's keying system as specified in Section 08 71 00.

1.6 QUALITY ASSURANCE

A. Single source: Casework and fume hoods to be manufactured and furnished by a single laboratory furniture company.

B. Manufacturer's qualifications: Modern plant with proper tools, dies, fixtures and skilled production staff to produce high quality laboratory casework and fume hoods, and shall meet the following minimum requirements:
1. Minimum of ten (10) years experience in manufacture of wood laboratory casework and fume hoods.
2. Ten (10) installations of equal or larger size.

C. Installer qualifications: Certified by the manufacturer.

D. Manufacturer to provide load test results certified by an independent testing laboratory for drawers, doors, suspension slides and unit shelving.

E. Casework construction and performance characteristics shall be in full compliance with SEFA 8 standards. At the Owner's request, independent, third part testing must be submitted validating compliance and adheres to the architectural specifications.

1.7 PROJECT CONDITIONS

A. Do not deliver or install wood product until the following conditions are met:
1. Windows and doors are installed and the building is secure and weathertight.
2. Ceiling, overhead ductwork and lighting are installed.
3. All painting is completed and floor tile is installed.
4. Interior building temperature to be between 65 degrees F and 80 degrees F, and ambient relative humidity maintained between 25 percent and 55 percent prior to delivery, and during and after installation. Frequent and/or excessive changes in temperature and/or humidity levels during casework installation, or once casework is installed, shall be avoided to prevent damage to materials.

B. Field measurements shall be taken to verify that the equipment will fit into the designated space. Entryways, corridors and door openings shall be verified to ensure that the equipment be manufactured in a manner to permit it to be moved through properly into place.

1.8 DELIVERY, STORAGE AND HANDLING

A. Delivery: Schedule delivery so rooms are sufficiently complete that material can be installed immediately following delivery.

B. Casework: Protect finished surfaces from soiling or damage during handling and installation.

C. Work surfaces: Protect throughout the construction period.

1.9 WARRANTY

A. Warrant casework against becoming unserviceable or causing an objectionable appearance resulting from defects in materials and workmanship, including workmanship of installation. Materials provided by Casework Manufacturer shall carry a warranty for five (5) years from date of Substantial Completion. Other materials and equipment shall carry warranty by the product manufacturer.

B. Defects shall include, but not limited to:
1. Discoloration of finish.
2. Missing or loose parts.
3. Noisy or hard operation of moving parts.
4. Failure to meet specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design, materials, construction and finish of casework as specified represents the minimum acceptable standard of quality for wood laboratory casework.

B. Basis of Design Manufacturer: Sheldon Laboratory Systems**,** Crystal Springs, MS, (601) 892-2731. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
1. Campbell Rhea Caseworks.
2. Collegedale Casework LLC.
3. Diversified Woodcrafts, Inc.
4. Hamilton Laboratory Solutions, LLC.
5. Kewaunee Scientific Corp.
6. Leonard Peterson & Co.
7. Sheldon Laboratory Systems.
8. South Texas Woodmill, Inc.
9. TMI Systems Corporation.

2.2 CASEWORK DESIGN

A. Door and Drawer Design:
1. Lipped Overlay: Partial overlay design with 3/8 inch reveals between door or drawer and frame, door to door, door to drawer, drawer to drawer; 7/16 inch vertical reveal between doors/drawers and cabinet ends.

B. Standard grain pattern on end panels is vertical.

C. Grain pattern on cabinet fronts:
1. Combination Grain: Horizontal grain on drawer fronts, vertical grain on door fronts.

D. Cabinet end panels exposed to view after installation shall be specified as a "finished end" panel. All end panels not exposed to view after installation shall be as listed under "unexposed" plywood.

E. Cabinets to be rigid, self-supporting design for use in assembly or as single, interchangeable stand-alone units.

F. Flush Interiors: Surface mounted bottoms and offsets caused by front face frames which interfere with ease of cleaning are not acceptable.

G. Joinery: 32mm doweled joinery system glued, clamped and screwed. Dowels are to be hardwood, laterally fluted with chamfered ends and a minimum diameter of 8mm.

H. Where shown or required, provide products conforming to ADADG for barrier-free design.

2.3 CASEWORK MATERIALS

A. Hardwood:
1. Lumber core shall conform to ANSI/HPVA HP-1 product standards.
2. Hardwood lumber, clean and free of defects. All lumber kiln-dried to uniform moisture content of six (6) percent.
   a. Exposed material: Red Oak, Grade I minimum.
   b. Semi-exposed material: Select hardwood.
   c. Unexposed material: Sound hardwood of species suitable for the intended purpose.

B. Plywood:
1. Hardwood plywoods shall conform to ANSI/HPVA HP-1 product standards.
2. Core: 7-ply (3/4 inch thick) and 9-ply (one (1) inch thick) veneer core plywood with cross and face plies bonded with Type II water-resistant glue; drawers are 9-ply, 1/2 inch thick.
3. Face veneer:
   a. Exposed surfaces: Plain-sliced red oak veneer, grade A, selected for golden wheat color and narrow hearts.
   b. Semi-exposed: Same species as specified for exposed face veneer, grade 2 for oak.
   c. Unexposed: Same species as specified for exposed and semi-exposed veneer, grade at option of manufacturer.

C. Welded fiberboard: Tempered welded fiber shall be wood fibers and natural resin binding agent compressed into dense homogeneous sheets. Sheets are impregnated with a special tempering compound polymerized by baking to give exceptional strength, and shall conform to ANSI/AHA A135.4 Basic Hardboard for Class 1 tempered grade.

D. Glass: 7/32 inch for tall cases and unframed wall and upper case doors, 1/8 inch for framed wall and upper case doors, without imperfections or marred surfaces of clear float glass.

E. Glue: Laminating - Type II water-resistant; assembly - Type III water-resistant.

F. Edgebanding: 3mm hardwood of same species as exposed face veneers.

G. Finish: Highly chemical-resistant modified acrylic urethane finish with built in U.V. blocker or equal finish applied over stain of selected color. Finish shall meet performance characteristics of TR-5, Section 1500, AWI Architectural Woodwork Quality Standards (latest edition).

2.4 CASEWORK FABRICATION

A. Base Units:
1. Cabinet ends: 3/4 inch thick plywood with 3mm hardwood banding on front edges. Bore interior faces, as appropriate, for security panels, rails, and four rows of shelf support holes:
2. Levelers: Provide four (4) metal corner gusset levelers with threaded adjustment screws and floor pad on all base cabinets.
3. Top rails:
   a. Full Top Frame:
      1) Horizontal front top rail: One (1) inch x three (3) inch solid hardwood. Attach to cabinet ends with glued 8mm dowel joinery and screws.
      2) Vertical back top rail: 3/4 inch x 3-3/4 inch hardwood. Attach to cabinet ends with glued 8mm dowel joinery and screws.
      3) Top side rails: 3/4 inch x 1-1/2 inch hardwood between front horizontal and back vertical rails, glued and screwed in place.

4. Intermediate rails: Front horizontal intermediate rail: 3/4 inch x 1-1/2 inch exposed hardwood rail to be provided between doors and drawers. Secure to cabinet end panels with glued 8mm dowel joinery.
5. Toe space rail: 3-3/4 inch x 3/4 inch hardwood or 7-ply veneer core plywood, mounted between end panels with glued 8mm dowel joinery and metal fasteners, forming a 4 inch high x 2-1/2 inch deep toe space, closed to cupboard bottom.
6. Bottoms: 3/4 inch thick plywood, set flush and joined to cabinet end panels with glued 8mm dowels on 96mm spacing and metal fasteners. Front edge to be banded with 3mm hardwood banding.
7. Backs:
   a. Cupboard units: One-piece 3/16 inch thick hardboard, rabbetted into rear top rail for easy removal from inside of cabinet.
   b. Drawer units: Open back.
   c. Sink units: Half-height, one piece 3/16 inch thick hardboard, rabbetted into rear rail for easy removal from inside of cabinet.

8. Vertical dividers in combination cabinets: 1-1/2 inch thick plywood panel (frames not permitted) glued and screwed in place, top and bottom, with 3mm hardwood banding on front edge.
9. Security panels: None required.
10. Shelves (for base units): Veneer core plywood, 3mm hardwood banded on front edge, adjustable on 32mm centers:
    a. Full-depth shelf, 17-3/4 inches deep.
    b. Thickness: 3/4 inch thick for all shelves up to and including 30 inches wide, one (1) inch thick for all shelves over 30 inches wide.
    c. 1/2 inch wide x 1/2 inch high raised lip on all four (4) sides of shelves for spill containment.

11. Drawer construction:
    a. Box: Four-sided drawer box with back, front and sides of 12mm (1/2

inch nominal) 9-ply Birch plywood with chemical-resistant finish and finished top edges. (Three-sided drawer box attached to outer drawer front is not acceptable.) Sides shall be joined by Lock joint, glued and pinned.

b. Bottom: Nominal 1/4 inch, inset into all four (4) sides of drawer box and sealed with hot melt glue process around entire drawer bottom perimeter. Material to be white melamine-clad tempered hardboard.

12. Door and removable drawer front construction: 3 ply 3/4 inch thick (door) and 1/2 inch thick (drawer), particleboard core, hardwood framed all four (4) sides, face veneer on both surfaces, radiused edges all four (4) sides; doors to be routed on inside perimeter to allow 1/4 inch inset into door opening.

B. Hardware:

1. Drawer suspension: 3/4 extension, open roller, 75 lb. dynamic load, self-closing epoxy- coated Blum 230 series or equal on all drawers except file drawers. All file drawers to have full extension with overtravel, ball-bearing roller, 150 lb. dynamic load, zinc-plated Accuride 4034 series, or Architect approved equal.
2. Drawer and hinged door pulls: Satin chrome wire pulls.
3. Hinges: Provide two (2) hinges for doors up to 48 inches high; three (3) hinges or doors over 48 inches high. Notch for proper fit. 5-knuckle, institutional stainless steel hinges.
4. Unit shelf supports: Metal pin and socket.
5. Door catches: Adjustable, spring-actuated nylon roller.
6. Elbow catches: Spring type with strike.
7. Locks, where indicated on drawings: 5-pin tumbler keyed alike and master keyed to Owner's keying system specified in Section 08 71 00.

2.4 ACID STORAGE UNIT

A. Owner Furnished, Contractor Installed.

2.5 SAFETY GOGGLE COMPARTMENT CASES

A. Type/Construction: Provide 15 minute Timer

B. Dimensions: 28-1/2 inches H x 26-1/4 inches W x 10-1/4 inches D

C. Number/Location: As shown on drawings.

D. Fasteners: Of type, size, and finish recommended by manufacturer to suit application.

E. Approved Product/Manufacturer: Model # SE-1000 furnished with 36 pairs of SE1049 non-ventilated goggles with fog-free lens as manufactured by Flinn Scientific, Inc., or Architect approved equal.

2.6 FIRE BLANKETS

A. Type: Fire blanket in a metal container that easily mounts to wall.

B. Door: Drop hinge door allows for quick and easy access.

C. Blanket Size/Type: 66 inches wide x 72 inches long fire retardant-treated woolen blanket for smothering fires.

D. Number/Location: One (1) wall mounted in each Lab as shown on drawings.

E. Approved Product/Manufacturer: Model # SE3006 as manufactured by Flinn Scientific, Inc., Batavia, IL; (800) 452-1261, or Architect approved equal.

2.7 FLAMMABLE STORAGE CABINET

A. Description: Wooden Floor cabinet
   1. Dimensions:
      a. Exterior: 23-7/8 inches wide x 23-7/8 inches deep x 36-5/6 inches high.
      b. Interior: 21-7/8 inches wide x 21 inches deep x 34 inches high.
   2. Bottle Capacity: 18 gallons.

B. Features:
   1. Two (2) doors.
   2. Two (2) inch floor spill retention trough.
   3. One (1) adjustable shelf.
   4. Meets NFPA and OSHA standards.

C. Location: As shown on drawings.

D. Approved Product/Manufacturer: Floor Cabinet Model SE7021, with Nitric Acid Compartment Model SC8071 as manufactured by Flinn/SciMatCo, Batavia, IL; (888) 879-7620, or Architect approved equal.

2.8 ACID STORAGE UNIT

A. Description: Cabinet shall be constructed of one (1) inch thick high-density 9-ply plywood with interior completely lined with polypropylene (floor, interior walls, interior top and top tray.

B. Dimensions:
   1. Exterior: 36-1/2 inches high x 31 inches wide x 20 inches deep.
   2. Interior: 28-1/2 inches high x 29 inches wide x 17-1/4 inches deep.

C. Bottle Capacity: (30) 5 pint or (90) 1 pint.

D. Features:
   1. Recessed wooden door handle.
   2. Word “ACID” printed on cabinet with six (6) inch red letters.
   3. All wooden hinges.
   4. Four (4) leveling feet.

E. Location: As shown on drawings.

F. Approved Product/Manufacturer: Cabinet SC8051, with Nitric Acid Compartment Model SC8071 as manufactured by Flinn/SciMatCo, Batavia, IL; (888) 879-7620, or Architect approved equal.

2.9 SAFETY GOGGLE COMPARTMENT CASES

F. Type/Construction: Provide 15 minute Timer

G. Dimensions: 28-1/2 inches H x 26-1/4 inches W x 10-1/4 inches D

H. Number/Location: As shown on drawings.

I. Fasteners: Of type, size, and finish recommended by manufacturer to suit application.

J. Approved Product/Manufacturer: Model # SE-1000 furnished with 36 pairs of SE1049 non-ventilated goggles with fog-free lens as manufactured by Flinn Scientific, Inc., or Architect approved equal.

2.10 FIRE BLANKETS

F. Type: Fire blanket in a metal container that easily mounts to wall.

G. Door: Drop hinge door allows for quick and easy access.

H. Blanket Size/Type: 66 inches wide x 72 inches long fire retardant-treated woolen blanket for smothering fires.

I. Number/Location: One (1) wall mounted in each Lab as shown on drawings.

J. Approved Product/Manufacturer: Model # SE3006 as manufactured by Flinn Scientific, Inc., Batavia, IL; (800) 452-1261, or Architect approved equal.

2.11 FLAMMABLE STORAGE CABINET

A. Description: Wooden Floor cabinet
   3. Dimensions:
      c. Exterior: 23-7/8 inches wide x 23-7/8 inches deep x 36-5/6 inches high.
      d. Interior: 21-7/8 inches wide x 21 inches deep x 34 inches high.
   4. Bottle Capacity: 18 gallons.

E. Features:
   5. Two (2) doors.
   6. Two (2) inch floor spill retention trough.
   7. One (1) adjustable shelf.
   8. Meets NFPA and OSHA standards.

F. Location: As shown on drawings.

G. Approved Product/Manufacturer: Floor Cabinet Model SC7021, with Nitric Acid Compartment Model SC8071 as manufactured by Flinn/SciMatCo, Batavia, IL; (888) 879-7620, or Architect approved equal.

2.12 INSTRUCTOR AND DEMONSTRATION DESK

A. Approved Product/Manufacturer: Sheldon Laboratory Systems Model No. 16500 Focal Point Demonstration Desk, or Architect approved equal.
   1. 10’ length x 66” wide x 34” height.

2. 1" black molded epoxy resin top.
3. Sink assembly with unimix HW, CW, gas fixture.
   a. Cantilevered half round black Shelresin sink (22" L x 14-1/2" W x 5-1/2" D) I.D. with sink outlet
   b. Unimix #80030 combination hot water, cold water and gas fixture with wrist blade handles and soft flow aerator.
   c. 110V #85101-gfi duplex electric outlet
   d. One (1) upright rod assembly set consisting of two upright rods with integral C-clamp and one horizontal rod with two connectors.
   e. Trap not included.
4. Recessed rotating monitor well with hood and remote wireless keyboard.
5. Three storage cabinets.
6. Two tambour door storage cabinets with pullouts for printer.
7. All units with locks.

2.13 LABORATORY PEGBOARD

A. Approved Product/Manufacturer: Fisher-Hamilton Model No. 52L77900 Laboratory Pegboard consisting of 1 inch thick black resin pegboard (~~36~~ 24 inches by ~~36~~ 28 inches) with (~~38~~ 24) 5 inch long polypropylene pegs.

2.14 J-FRAME SUPPORT SYSTEMS

A. General: The 'J'-frame support structure shall consist of vertical (inverted 'J') support members and horizontal tubular frames.

B. Vertical 'J' Support Members:
   1. Vertical 'J' support members shall be 16 gauge, 1-1/4 inch square Type 304 stainless steel seamless tubing, heliarc welded where required, ground smooth at all joints and given a satin finish.
   2. The vertical support members shall be formed into an inverted 'J' maintaining a smooth contour without warp or twist in the metal. Each vertical support shall have a 1 inch height adjustment for handling various floor conditions and be so designed as to maintain a fixed position on the floor. A concealed 'hold-down' angle or other means will be acceptable. Molded vinyl tapered leg shoes shall be furnished at each support leg to conceal the adjustment device and/or 'hold-down' angle. Each support shall have two 5/16 inch - 18 stud bolts supplied for each side for securing the horizontal frames. Cap nuts shall be furnished for all exposed studs.

C. Horizontal Frames: All horizontal frames shall have a 1-1/4 inch square tubing front and rear members. Horizontal frames shall be 16 gauge, Type 304 stainless steel, heliarc welded throughout ground smooth at all joints and given a satin finish.

D. "J"-Frame Performance Requirements: The support structure shall be designed for heavy-duty laboratory usage, and when a wall table is completely assembled with work top and cabinets in place, it shall support the following loads:
   1. A 7 foot long wall table assembly with 4 foot and 3 foot modular spacing shall support a load of 1,500 lbs. uniformly distributed over the work top area.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Casework installation:
   1. Set casework components plumb, square, and straight with no distortion and securely anchored to building structure. Shim as required using concealed shims.
   2. Fasten continuous cabinets together with joints flush, tight and uniform, with alignment of adjacent units within 1/16 inch tolerance.
   3. Secure wall cabinets to solid supporting material, not to plaster, lath or gypsum board. Blocking in wall by rough carpentry as specified in Section 06 10 00.
   4. Abut top edge surfaces in one true plane. Provide flush joints not to exceed 1/8 inch between top units.

B. Work surface installation:
   1. Where required due to field conditions, scribe or caulk to abutting surfaces.
   2. Secure joints in the field, where practicable, in the same manner as in factory, with dowels, adhesive or fasteners recommended by manufacturer.
   3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.

C. Sink installation: Sinks shall be set in chemical-resistant sealing compound, secured and supported per manufacturer's recommendations.

D. Accessory installation: Install accessories and fittings in accordance with manufacturer's recommendations. Turn screws to seat flat; do not drive.

3.2 ADJUSTING

A. Repair or remove and replace defective work, as directed by Architect upon completion of installation.

B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.3 CLEANING

A. Broom clean finished casework, touch up as required.

B. Clean materials as recommended by manufacturer.

3.4 PROTECTION OF FINISHED WORK

A. Provide necessary protective measures to prevent damage of casework and equipment from exposure to other construction activity.

B. Advise contractor of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

END OF SECTION 12 35 53.19

SECTION 12 35 83 - PERFORMING ARTS CASEWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Musical Library System.
   2. Storage Cabinets.
   3. Tuba/Sousaphone Wall Bracket.
   4. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 09 65 13 - Resilient Base and Accessories.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.

B. Shop Drawings:
   1. Complete shop drawings for the Architect’s approval.
   2. Unit layout for Owner's approval.

C. Samples: Include color charts showing manufacturer's full range of colors for Architect’s selection.

1.5 WARRANTY

A. Storage - Written warranty in which manufacturer agrees to repair or replace components of installation that fail in materials or workmanship within specified warranty period:
   1. Warranty does not include deterioration or failure pet due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Melhart Music Center.
   2. TMI Systems Design Corp.
   3. Wenger Corporation (The).

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 MATERIALS AND MANUFACTURERS

A. Music Library System - Standard width 7-shelf unit:
   1. Basis of Design: Model 173G700 manufactured by The Wenger Corporation.
   2. Overall Dimensions:
      a. Closed Position: Refer to Drawings.
      b. Open Position: refer to Drawings.
   3. Pull out design, equally spaced shelves provide 10-1/2 inch of available height per shelf.

4. Cabinet Doors: Vertical Wire grille.
5. Frame: 16 gauge, 1 inch square tubular steel, painted black.
6. Color: Architect to select from Manufactuer's full range.

B. Storage Cabinets:
1. Basis of Design: UltraStor Storage Cabinets manufactured by The Wenger Corporation.The required cabinet model number within this product range are provided in the construction drawings where the specification is tagged.
2. Wall Panels: 3/4 thick industrial grade composite wood with no added formaldehyde and polyester laminate finish in manufacturer’s standard colors.
3. Shelves: Blow-molded polyethylene mounted with self-lock shelf supports.
4. Grooved shelves allow air to circulate.
5. Edging: 1/8 inch radiused PVC.
6. Door Options: Architect to select.
7. Cabinets: Five adjustable steel leveling glides for uneven floors.
8. Cabinet Doors: Vertical wire grille.
9. Doors: Heavy-duty, 5-knuckle institutional ANSI/BHMA A156.9.
10. Color: Architect to select from Manufactuer's full range.

C. Tub/Sousaphone Wall Bracket:
1. Basis of Design: Model #049E100 Tuba/Sousaphone Wall Bracket as manufactured by The Wenger Corporation.
2. Height: Adjusts from 22-1/2 inch min. to 35 inch max.
3. Width: Adjusts 13-1/2 inch min. to 22 inch max.
4. Color: Architect to select from Manufactuer's full range.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Adjust for proper operation.

C. Installation of four (4) inch rubber base.

END OF SECTION 12 35 83

SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Countertops for architectural cabinet work.
   2. Countertops for manufactured casework.
   3. Wall-hung counters and vanity tops.
   4. Sinks molded into countertops.
   5. Epoxy resin sinks.
   6. Countertop supports.

B. Related Sections:
   1. Section 11 53 13 - Laboratory Fume Hoods: Work surfaces inside fume hoods.
   2. Section 12 35 53.19 - Wood Laboratory Casework: Laboratory countertops.
   3. Section 22 40 00 - Plumbing Fixtures: Sinks.

1.3 PRICE AND PAYMENT PROCEDURES

A. Refer to Section 01 21 00 - Allowances, for cash allowances affecting this section.

B. Refer to Section 01 23 00 - Alternates, for product alternates affecting this section.

1.4 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

E. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2018.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

G. AWI (QCP) - Quality Certification Program; Current Edition.

H. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

I. AWMAC (GIS) - Guarantee and Inspection Services Program; Current Edition.

J. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

K. IAPMO Z124 - Plastic Plumbing Fixtures; 2022.

L. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

M. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.

N. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

O. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

P. NSF 51 - Food Equipment Materials; 2019.

Q. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.

R. PS 1 - Structural Plywood; 2009 (Revised 2019).

S. SEFA 2 - Installations; 2010.

T. SEFA 3 - Laboratory Work Surfaces; 2010.

U. WI (CCP) - Certified Compliance Program (CCP); Current Edition.

V. WI (CSIP) - Certified Seismic Installation Program (CSIP); Current Edition.

W. WI (MCP) - Monitored Compliance Program (MCP); Current Edition.

1.5 PERFORMANCE REQUIREMENTS

A. Countertops and Vanities: Provide countertop and vanity framing capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
   1. All deadloads.
   2. 500 pound live load placed on the countertop and vanity.
   3. Deflection at Midspan: L/1000 times span or 1/8 inch whichever is less.

1.6 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

H. Installer's qualification statement.

I. Installation Instructions: Manufacturer's installation instructions and recommendations.

J. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. Warranty the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include but not be limited to the following:
   1. Rough or difficult operation, or loose or missing parts.
   2. Delamination of surfaces.
   3. Noticeable deterioration of finish.
   4. Warped or misaligned surfaces or telegraphing of subsurface imperfections.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Quality Standard: SEFA 3 for laboratory worksurfaces.

C. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
      a. Manufacturers:
         1) Arborite: www.arborite.com/#sle.
         2) Formica Corporation: www.formica.com/#sle.
         3) Panolam Industries International, Inc; Pionite ThruColor: www.panolam.com/#sle.
         4) Wilsonart: www.wilsonart.com/#sle. Basis of Design.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. NSF approved for food contact.
      d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
      e. Laminate Core Color: Same as decorative surface.
      f. Surface Color and Pattern: 4945-38 Organic Cotton as manufactured by Wilsonart..
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch (32 mm) thick; covered with matching laminate.
   3. Back and End Splashes: Same material, same construction.
   4. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.
   5. Fabricate in accordance with manufacturer's standard requirements.

D. Solid Surfacing Countertops (SCT-1-2: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces: www.avonitesurfaces.com/#sle.

2) Dupont: www.corian.com/#sle.
3) Formica Corporation: www.formica.com/#sle.
4) Wilsonart: www.wilsonart.com/#sle. (Basis of Design).

b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
c. NSF approved for food contact.
d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
e. Color and Pattern: As selected by Architect from manufacturer's full line.

3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
5. Skirts: As indicated on Drawings.
6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.
7. Fabricate in accordance with manufacturer's standard requirements.

E. Solid Surfacing Bench: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Flat Sheet Thickness: 1/4 inch (6 mm), minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
a. Manufacturers:
1) American Bath Group: www.americanbathgroup.com/#sle.
2) Meganite, Inc: www.meganite.com/#sle.
3) Procelanosa.
4) Wilsonart.
3. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
4. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
5. Basis of Design:
a. SSB1: Procelanosa.
1) Color: Krion Fruit 3601.
b. SSB2:Procelanosa
1) Color: Krion White Copper 9106.
c. SSB3: Wilsonart.
1) Color: 9101GS Oatmeal.
6. Edge: As indicated on Drawings for each type.
7. Fabricate in accordance with manufacturer's standard requirements.

F. Stainless Steel Countertops: Type 304, stainless steel sheet; 16 gauge, 0.0625 inch (1.59 mm) nominal sheet thickness.
1. Finish: 4B satin brushed finish.
2. Edge and Backsplash Sink Details: As indicated on Drawings.
3. Exposed Edge Shape: Straight turndown with return.
4. Back and End Splashes: Same material; welded 1/4 inch (6 mm) radius coved joint to countertop; square top edge with 1 inch (25 mm) wide top surface and minimum 1/2 inch (12 mm) turndown.
5. Splash Dimensions: 4 inch (100 mm) high by 1 inch (25 mm) thick, unless otherwise indicated.
6. Splash Depth Where Faucets are Mounted in Splash: 2 inches (50 mm).
7. Splash Height: 6 inch (150 mm).
8. Sinks: Same material, same thickness; flush welded to counter; bottom sloped to outlet; radiused interior corners; drain outlet located in back corner.
9. Troughs: Same material; bottom sloped to outlet.
10. Associated Reagent Shelves: Same material, with formed raised edges.

11. Associated Window Stools: Same material, same thickness.

G. Chemical-Resistant Plastic Laminate Countertop:
1. Basis of Design: Chemsurf by Wilsonart.
2. Core Color: Brown.
3. Surface Color: 1595 Black.
4. Edge: Built- Up Squared.

2.3 ACCESSORIES

A. Countertop and Vanity Supports:
1. Custom Fabricated Countertop and Vanity Framing:
a. Material: Steel

b. Fabrication: Fabricate countertop and vanity framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thicknesses, sizes and shapes shown, and as required to produce work of adequate strength and durability, without objectionable deflections. Useproven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work.

c. Finish: Powder Coat.
1) Color: Black.
2. Pre-Fabricated Countertop and Vanity Supports:
a. Material: Aluminum.
b. Finish: Powder Coat.
1) Color: As Selected by Architect.
c. Basis of Design: Rakks manufactured by Rangine Corporation.

2.4 MATERIALS

A. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.
2. Provide sustainably harvested wood, certified or labeled; refer to Section 01 60 00 - Product Requirements.
3. Provide wood harvested within a 500 mile (805 km) radius of the project site.
4. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless otherwise noted, provided it is clean and free of contamination; identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

D. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.

E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

F. Cove Molding for Top of Splashes: Rubber with semi-gloss finish and T-spline to fit between splash and wall; 1/2 inch (12 mm) by 1/2 inch (12 mm).
1. Color: As indicated on drawings.
2. Color: As selected by Architect from manufacturer's full line.

G. Joint Sealant: Mildew-resistant silicone sealant, white.

H. Polyester Protective Film: Scratch-, heat-, and acid-resistant optically clear removable polyester film for bonding to stone counters.
1. Thickness: 4 mil, 0.004 inch (0.1 mm), minimum.
2. Finish: Gloss.
3. Construction: Multi-ply laminate.

4. Adhesive Type: Pressure sensitive acrylic.
5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84 (Class A).
6. NSF approved for food contact per NSF 51.
7. Products:
   a. Stoneguard USA; www.stoneguardusa.com/#sle.
   b. Surface Shields, Inc; www.surfaceshields.com/#sle.
   c. TuffSkin Surface Protection LLC; TuffSkin: www.tuffskin.com/#sle.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

I. Sealer: Stain and acid protection for natural stone counters.
1. NSF approved for food contact per NSF 51.
2. Products:
   a. Custom Building Products; www.custombuildingproducts.com/#sle.

b. Rockstar Sealing, a division of TuffSkin Surface Protection LLC; Natural Finish Stone Sealer: www.rockstarsealing.com/#sle.
c. STONETECH, a division of LATICRETE International, Inc; www.laticrete.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
a. Rout a 1/8 inch (3 mm) drip groove at underside of exposed overlapping edges, set back 1/2 inch (13 mm) from face of edge.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash where indicated on Drawings.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3,657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.

D. Stainless Steel: Fabricate tops up to 144 inches (3,657 mm) long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
1. Weld joints; grind smooth and polish to match.
2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
3. Provide wall clips for support of back/end splash turndowns.
4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.
5. Integral sinks: Fabricate with corners rounded and coved, double-walls for sink compartment partitions, and drainboards. Factory-punch holes for fittings, and weld sinks to countertops.

E. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install vanities in accordance with manufacturer’s instructions and approved shop drawings

B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

C. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).

D. Attach stainless steel countertops using stainless steel fasteners and clips.

E. Attach epoxy resin countertops using compatible adhesive.

F. Apply sealer products in accordance with manufacturer's written instructions.

G. Seal joint between back/end splashes and vertical surfaces.
   1. Where indicated use rubber cove molding.
   2. Where applied cove molding is not indicated use specified sealant.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.5 CLEANING

A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12 36 00

SECTION 12 66 13 - TELESCOPING BLEACHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Electrically operated, wall attached with rear wall column cutouts, telescoping gym seating systems of multiple-tiered seating rows comprising of seat, deck components, understructure that permits closing without requiring dismantling, into a nested configuration for storing or for moving purposes.

1.3 RELATED SECTIONS

A. Division 3, Cast-In-Place Concrete and Division 9, Finishes: Floor and wall finishes sections for adequate floor and wall construction for operation of telescoping gym seats. Flooring shall be level and rear wall plumb within 1/8 inch in 8 feet-0 inches. Maximum bleacher force on the floor, of 25 feet-6 inch section, shall be a static point load of less than 300 psi.

B. Division 26 - Electrical: Electrical wiring and connections for electrically operated motor system.

1.4 MINIMUM COMPLIANCE STANDARDS

A. American with Disabilities Act (ADA)

B. NFPA Standard 102, Section 4, "Folding and Telescoping Seating", current edition, governs the work except where more restrictive items are specified.

C. Texas Accessibility Standards (TAS)

1.5 SUBMITTALS

A. Product Data:
   1. Manufacturer’s schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.
   2. Manufacturer’s installation instructions.
   3. Manufacturer’s maintenance instructions for instructing and demonstrating the proper maintenance to the Owner.

B. Shop Drawings: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

C. Samples: Submit two (2) 18 inch long samples of seat boards.

1.6 SPECIAL WARRANTY

A. Warrant the work specified for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
1. Rough or difficult operation
2. Noisy operation
3. Loose or missing parts

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers listed who produce equivalent products to those specified are approved for use on the Project with Architect's approval. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
1. Aalco, St. Louis, MO; (800) 537-1259
2. Folding Bleacher Co., Subsidiary of Irwin Seating Company, Altamont, IL; (618) 483-6157
3. Hussey Seating Co., North Berwick, ME; (207) 676-2271
4. Interkal, Inc., Kalamazoo, MI; (616) 349-1521
5. Kodiak Industries, Ltd. Winnipeg, Manitoba Canada; (204) 942-0091 (School Specialty, Willis, TX; (409) 890-0123)

B. Specifications are based on Maxam Model MXM26 Series Telescopic Gym Seats manufactured by Hussey Seating Co.

2.2 BLEACHERS, GENERAL

A. Primary Bleachers at Gym:
1. Row Spacing: 22, 24, or 26 inches as shown on drawings.
2. Seat Height: 17 or 18 inches as shown on drawings.
3. Rise: 9-5/8 inches from seat to seat.
4. Seat Width: Ten (10) inches minimum.
5. Foot Boards: Full width.
6. Number of Rows: As shown on drawings.
7. Length of each unit: As shown on drawings.
8. Provide aisles with intermediate steps and aisle rails as shown on drawings and required by code.

2.3 MATERIALS

A. Riser, Deck, and Seatboard Material:
1. Seat Board: MVP (plastic set module) in color(s) to be selected by Architect from manufacturers available colors.
2. Riser: Plated steel
3. Aisles and Decks: CD grade 5/8 inches plywood, urethane finished.

B. Design Features:
1. Liveload: (Of whole bleacher) 100 psf of horizontal projection.
2. Liveload: (Seatboards and platforms) 120 psf

3. Sway Load: Parallel, 24 pounds, per linear foot; perpendicular, ten (10) pounds per linear foot.
4. End Panels: Provide end panels where exposed to view.
5. Rails: Self-storing rail, removable end rails, front railings, rear rails, aisle hand rails.
   a. Hand railings, posts and supports shall be engineered to withstand a concentrated load of 200 lbs. applied at any point and in any direction and a uniform load of 50 lbs. per foot applied in any direction, applied separately.
   b. Guard railings, post and supports shall be engineered to withstand a concentrated load of 200 lbs. applied at any point and in any direction along top rail and a uniform load of 50 lbs. per foot applied horizontally at top rail and a simultaneous uniform load of 100 lbs. per foot applied vertically downward, applied separately.
6. Wheels: Non-marking, extra wide, heavy duty rubber, self lubricating wheels of size and number to suit the wooden floor surfacing. Coordinate location of wheels so that they do not conflict with athletic floor sleeves (i.e. volleyball sleeves).
7. Wheel Chair Accessible Area: Provide spaces as indicated on the drawings with safety rails and end panels complying with ADA and TAS.
8. Removable Scorers Table:
   a. High pressure laminate over plywood core.
   b. 1 foot-3 inches x 8 feet-0 inch minimum size.
   c. Folding tubular legs for storage, mounting sockets in bleacher deck.
9. Delete key locks on front of first step risers.
10. Provide a minimum of two (2) removable access panel sections in each set of bleachers. The access panels shall be of the manufacturer's standard access panels located at the stair sections of the bleachers for maintenance access to the underside of the bleachers.
11. Full Section Recoverable Truncation: Provide a combination programming support and front rail as required to support full section recoverable truncation with remaining lower rows stored beneath. Support/front rail to extend 38" [965] above deck and be designed to sustain live load of first seating row being programmed.
12. On 1st Row, provide front and side skirt boards anywhere there is an exposed end to prevent players/balls from sliding underneath the 1st Row.
13. Fabric:
   a. Provide fabric or vinyl bleacher curtains at ends of bleachers.
   b. Color to be selected by Architect at a later date from full range of possible color options.

C. Operation:
1. Method: Telescope into a stack
2. Operator: Electric friction motor operated mounted at front of bleachers. Chain driven non-friction operation not acceptable. Integral power with pendant control powered frame system. Motorized bleachers shall have 3-position toggle switches which shall be provided with the bleachers and installed by Division 16. The Toggle Switches shall be installed in a lockable access panel at the location designated on the plans.
2. Partial Opening: Permit one (1) or more rows to open; lock into any position.
3. Even Spacing: Mechanism designed to hold all spaces evenly. Provide automatic alignment of units when in operational stages.
4. Allow varying numbers of rows to be telescoped out and used at any given time.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be performed.

B. Verify flooring is level and rear wall is plumb within 1/8 inch in 8 feet-0 inches.

C. Bring discrepancies and unsatisfactory conditions to the attention of the Architect and do not proceed until such discrepancies and unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Use only experienced factory authorized installers.

B. Install in accordance with manufacturer's printed instructions.

C. Adjust for smooth, quiet operation.

END OF SECTION 12 66 13

SECTION 14 20 00 - ELEVATORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: Requirements including but not limited to:
   1. Commercial, standard preengineered hydraulic passenger elevator.
   2. Elevator car enclosures, hoistway entrances and signal equipment.
   3. Equipment, machines, controls, systems and devices necessary for operation.
   4. Materials and accessories necessary to complete the elevator installation.

1.3 DEFINITIONS

A. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

B. Definitions in ASME A17.1/CSA B44 apply to work.

C. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 SUBMITTALS

A. Product Data: Technical data including capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.

B. Shop Drawings: Submit plans, elevations, sections, and large scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.
   1. Include large scale layout of car control station.
   2. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.

C. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, and machine room layout and dimensions, shown on Drawings, and electrical service, shown and specified, are adequate for elevator system being provided.

D. Submittals:
   1. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
   2. Set of service tools.
   3. Provide one electronic copy and two hard copies of manuals and inspection reports. Provide two complete printed sets of service, parts, schematic diagrams and adjustment manuals. Prints required by state code for each elevator.
   4. Provide four copies of independent service keys. Provide 4 factory cut keys for every lock on each elevator and label use. Provide two extra copies of the independent service key for a total of 6 keys.
   5. Final inspection by the state inspector shall have a School District representative present to observe. Complete the final documentation for the State Inspection and return to the School District Maintenance Department.
      a. The Owner shall apply for the operation/inspection certificate provided by the State Inspector. Cost of the state inspection shall be paid by the elevator subcontractor/ manufacturer.

E. Operation and Maintenance Data: Submit for elevators to include in emergency, operation, and maintenance manuals and parts list, with recommended parts inventory.

F. Inspection and Acceptance Certificates and Operating Permits: Required by authorities having jurisdiction for normal, unrestricted elevator use.

G. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a two year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options. Maintenance agreement includes but is not limited to:
   1. Systematic examination, adjustment, and lubrication of all elevator equipment.
   2. Repair or replacement of electrical and mechanical parts of the elevator installation as required, using only the genuine standard parts approved for the original installation.
   3. Maintenance work as required during regular working hours and regular working days, but with emergency callback service available at all times during this maintenance period.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable provisions of the IBC and the Elevator Code.
   2. Elevator Standard: Comply with ASME A17.1/CSA B44.
   3. Fire Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 and IBC.
   4. Accessibility Requirements: Comply with applicable requirements.
      a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) 2010.
      b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      c. Texas Accessibility Standards (TAS) 2012.

B. Manufacturer/Installer Qualifications: Elevator manufacturer having minimum 10 years documented experience who is trained and approved by manufacturer, including but not limited to:
   1. Manufacturer of the power unit, controller, signal fixtures, door operators cab, entrances, and other major parts of the elevator operating equipment.
   2. Primary and major equipment components are manufactured in the United States and are not be an assembled system.
   3. Documented, ongoing quality assurance program.

C. Source Limitations: Obtain elevators through one source from a single manufacturer.
   1. Provide major elevator components, including pump and tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

D. Inspection and Testing: Elevator Installer shall obtain and pay for required inspections, tests, permits and fees for elevator installation.
   1. Arrange for inspections and make required tests.
   2. Deliver documentation to the Owner upon completion and acceptance of elevator work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.7 COORDINATION

A. Coordinate dimensions with structure, walls, and adjacent features.

B. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

C. Furnish well casing and coordinate delivery with related excavation work.

D. Coordinate locations and dimensions of other work specified that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.8 WARRANTY

A. Written warranty signed by manufacturer in which manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
   2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design: Thyssen Krupp, Endura A3000; subject to compliance with requirements, provide basis of design or comparable by one of the following:
   1. Fujitec America, Inc.
   2. Otis Elevator.
   3. Schindler Elevator Corporation.

2.2 FINISH MATERIALS

A. Cold Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

B. Hot Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

C. Stainless Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Textured Stainless Steel Sheet: ASTM A 240/A 240M, Type 304, with embossed texture rolled into exposed surface.

E. Stainless Steel Bars: ASTM A 276, Type 304.

F. Stainless Steel Tubing: ASTM A 554, Grade MT 304.

G. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.

2.3 ELEVATOR SYSTEM

A. Elevator System: Machine roomless, holeless hydraulic elevator system with standard components included in elevator systems necessary for complete system.

B. Elevator Description:
   1. Rated Load: 3000 lb (1360.77 kg).
   2. Rated Speed: 100 fpm (0.51 m/s).
   3. Operation System: Single automatic operation.
   4. Car Enclosures:
      a. Inside Width: Indicated on drawings.
      b. Inside Depth: Indicated on drawings.
      c. Inside Height: Indicated on drawings.
      d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
      e. Car Fixtures: Satin stainless steel, No. 4 finish.
      f. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
      g. Reveals: Stainless Steel, Powder coatBlack.
      h. Door Faces (Interior): Satin stainless steel, No. 4 finish.

i. Door Sills: Nickel silver.
j. Ceiling: As indicated on Drawing
k. Handrails: 1/2 inch by 2 inches (13 by 50 mm) rectangular, at rear of car.
l. Floor prepared to receive resilient flooring.

5. Hoistway Entrances:
   a. Width: 42 inches (1067 mm).
   b. Height: 84 inches (2134 mm).
   c. Type: Single speed center opening.
   d. Frames: Satin stainless steel, No. 4 finish.
   e. Doors: Satin stainless steel, No. 4 finish.
   f. Sills: Nickel silver.
6. Hall Fixtures: Satin stainless steel, No. 4 finish.
7. Additional Requirements:
   a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
   b. Provide hooks for protective pads and one complete set of full height protective pads.

C. Pump Units: Positive displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
   1. Pump shall be submersible type with submersible squirrel cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts.
   2. Motor shall have solid state starting.
   3. Motor shall have variable voltage, variable frequency control.
   4. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation absorbing material in blowout proof housing at pump unit.
   5. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
      a. Cylinder units shall be connected with dielectric couplings.
      b. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
   6. Hydraulic Fluid: Nontoxic, biodegradable, fire resistant fluid, made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal passivating additives, that is approved by elevator manufacturer for use with elevator equipment.
   7. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified Section 055000.
   8. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1/CSA B44, of sufficient size to provide not less than 1 inch (25 mm) clearance from cylinder and extending above pit floor. Casing shall have means of monitoring effectiveness to comply with ASME A17.1/CSA B44.
   9. Corrosion Protective Filler: A nontoxic, petroleum based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler shall be electrically nonconductive, displace or absorb water, and gel or solidify at temperatures below 60 degrees F (16 degrees C).

D. Car Frame and Platform: Welded steel units.

E. Guides: Roller guides; provide guides at top and bottom of car frame.

F. Operating Systems: Provide standard microprocessor operation system required to provide type of operation indicated.
   1. Elevator to recieve card reader for elevator calling and cabin operations.
   2. Auxiliary Operations:
      a. Single Car Standby Powered Lowering: On activation of standby power, car is lowered to the lowest floor, opens its doors, and shuts down.

b. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after 5 minutes and are re-energized before car doors open.

G. Door Reopening Devices:
1. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
2. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.4 CAR ENCLOSURES

A. Provide steel framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.
1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Standards, but not less than the following:
1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8 inch (15.9 mm) nominal thickness.
2. Floor Finish: Refer to Section 09 65 00.
3. Stainless Steel Wall Panels: Flush, formed metal construction; fabricated from stainless steel sheet.
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. Stainless Steel Doors: Flush, hollow metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled or powder coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
7. Sight Guards: Provide sight guards on car doors.
8. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
9. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
10. Light Fixture Efficiency: Not less than 35 lumens/W.
11. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).

2.5 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Horizontal sliding, door and frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
1. Where gypsum board wall construction is indicated, frames shall be self supporting with reinforced head sections.

B. Fire Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
1. Fire Protection Rating: 1 hour with 30 minute temperature rise of 450 degrees F (250 degrees C).

C. Materials and Fabrication: Standard, but not less than the following:
1. Steel Subframes: Formed from cold or hot rolled steel sheet, with factory applied enamel or powder coat finish or rust resistant primer. Fabricate to receive applied finish as indicated.
2. Stainless Steel Frames: Formed from stainless steel sheet.

3. Stainless Steel Doors: Flush, hollow metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled or powder coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil canning.
4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
6. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.6 SIGNAL EQUIPMENT

A. Provide hall call and car call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal resistant buttons and lighted elements illuminated with LEDs.

B. Car Control Stations: Provide recessed or semirecessed car control stations. Mount in return panel adjacent to car door unless otherwise indicated.
1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car control station, either integral with car control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two Way Telephone Communication Service: Provide flush mounted cabinet and required conductors in traveling cable for firefighters' two way telephone communication service.

E. Car Position Indicator: Provide digital type car position indicator, located above car door or above car control station. Provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push Button Stations: Provide one hall push button station at each landing.
1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.

G. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide the following:
1. Wall mounted units, for mounting above entrance frames.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
1. At manufacturer's option, audible signals may be placed on cars.

I. Hall Position Indicators: Provide digital display type position indicators, located above hoistway entrance at ground floor.
1. Provide units with flat faceplate for mounting and with body of unit recessed in wall.
2. Integrate ground floor hall lanterns with hall position indicators.

J. Standby Power Elevator Selector Switches: Provide switches, required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.

K. Fire Command Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), required by

ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

L. Emergency Pictorial Signs: Fabricate from materials matching hall push button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elevator areas for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report listing conditions detrimental to performance of the work.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Install piping above the floor, where possible. Install underground piping in casing.
   1. Excavate for piping and backfill encased piping according to applicable requirements.

E. Lubricate operating parts of systems recommended by manufacturers.

F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

G. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and travel direction.

H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

I. Locate hall signal equipment for elevators as follows unless otherwise indicated:
   1. Place hall lanterns either above or beside hoistway entrance.
   2. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Do not use elevator for construction purposes:

3.5 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator.

B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 24 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   1. Perform maintenance during normal working hours.
   2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 14 20 00

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION SYSTEM

C. SECTION 21 05 48.13 - VIBRATION CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

D. SECTION 21 11 13 – FIRE SUPRESSION SYSTEMS.

E. SECTION 21 30 00 - FIRE PUMPS AND EQUIPMENT

F. SECTION 28 31 00 - FIRE DETECTION AND NOTIFICATION SYSTEMS.

1.2 SUMMARY

A. Provide all work for mechanical, plumbing and fire protection systems required in the project to be properly installed, tested and performing their intended function.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.

1.3 QUALITY ASSURANCE

A. Shop drawings and hydraulic calculations are to be sealed by a NICET III or IV sprinkler designer licensed in the state of Texas.

B. Perform all work in accordance with the latest edition of the applicable codes, specifications, local ordinances, industry standards, utility company regulations, nationally accepted codes.

C. All materials and distribution, and utilization equipment shall be UL Listed.

D. All equipment and materials shall be new, unused and of United States Domestic manufacture unless approved otherwise by engineer or owner.

E. Eliminate any abnormal sources of noise that are considered by the Architect or Engineer not to be an inherent part of the systems as designed without additional cost to the Owner

1.4 QUALIFICATION OF CONTRACTORS

A. The Contractor for the fire protection installation shall be a certified fire protection contractor, licensed for the installation of automatic fire sprinkler systems and other fire protection equipment.

B. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system.
2. Shop drawings and hydraulic calculations are to be sealed by a NICET III or IV sprinkler designer licensed in the state of Texas
3. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

1.5 DESIGN STANDARDS

A. Fire Protection systems shall be designed and installed in accordance with the requirements of the most current version of the following codes, standards and design guides:

1. The International Fire Prevention Code
2. The International Building Code
3. National Fire Protection Association (NFPA) Standards:
   a. NFPA 101 - Life Safety Code
   b. NFPA 13 - Installation of Sprinkler Systems
   c. NFPA 14 - Installation of Standpipe and Hose Systems
   d. NFPA 20 - Installation of Centrifugal Fire Pumps
   e. NFPA 24 - Installation of Private Fire Service Mains
   f. NFPA 25 - Inspection, Testing, and Maintenance of Water-based Fire Protection Systems
   g. NFPA-2001 – Standard for Clean Agent Fire Extinguishing Systems

B. Factory Mutual (FM) Approval Guide

C. Underwriters Laboratories Inc. (UL)

D. Owner’s Insurance Underwriter Requirements

1.6 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Architect shall be notified of the discrepancy.

D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of Section 23 00 00 - Mechanical General.

1.7 WORK INCLUDED

A. Code compliance, research, design coordination, and installation or a complete and functional hydraulically calculated wet pipe sprinkler system that meets the approval, and is in accordance with the requirements of NFPA Fire Protection Standards listed in 1.4 (a), Underwriters Laboratory (UL), all local and sate regulations, and these specifications.

B. Alarm devices including alarm valves, flow switches/pressure switches, tamper switches and coordination with Fire Alarm and Detection Contractor.

C. Shop drawings and calculations prepared and submitted in accordance with the requirement of all Authorities Having Jurisdiction.

D. All permits and approvals of the fire protection system.

E. SYSTEMS: Plumbing Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to, the following as noted below. The connection point for all systems from the site utilities shall be as 5'-0" from the exterior of the building unless specifically otherwise noted.
1. Access Panels
2. Floor, Wall, and Ceiling Plates
3. Insulation
4. Heatrace
5. Piping and Equipment Identification
6. Painting

1.8 COORDINATION WITH OTHER TRADES

A. Coordinate the work of this division with all other divisions to ensure that all components of the mechanical, plumbing and fire protection system will be installed at the proper time and fit the available space.

B. Locate and size all openings in work of other trades required for the proper installation of the mechanical, plumbing and fire protection system components.

C. Make all mechanical, plumbing and fire protection connections to all equipment furnished by this division and as required by any other division.

D. Electrical wiring, control equipment and motor starters indicated on the electrical drawings, except items otherwise specifically noted, shall be furnished and installed by the electrical trades. Items of electrical control equipment specifically mentioned to be furnished by the mechanical trades, either in these specifications or on the mechanical drawings, shall be furnished, mounted and wired by this trade unless where otherwise specified in Division 26 or noted on the electrical drawings to be by the electrical trades. All wiring shall be in accordance with all requirements of the electrical Sections of these specifications.

E. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment. All controllers furnished with mechanical equipment shall have overload protection in all phases. It shall be the responsibility of each subcontractor furnishing motors and devices to advise Electrical Contractor of exact function of systems to assure proper type of starter with correct number auxiliary contacts for proper operation of the system.

F. The mechanical trades shall coordinate with the electrical to ensure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

G. The design of the electrical systems is based on the mechanical equipment specified and scheduled on the drawings. Where changes or substitutions are made that involve additional electrical work (larger-size motors, larger number of motors, additional wiring of equipment, etc.), the mechanical trades shall pay the electrical trades for the cost of the additional work, except for changes by bulletin.

H. Motor control equipment which is furnished loose under Division 23 shall be delivered to the Electrical Contractor at the site for custody, erection in place, and wiring as specified.

I. Smoke detection systems will be furnished and installed under Division 26 – electrical. Coordinate locations with Electrical Contractor.

1.9 DRAWINGS

A. The drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Determine exact locations by review of equipment manufacturer's data, by job site measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The size of the mechanical, plumbing and fire protection equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed manufacturers will be acceptable, it is the responsibility of the Contractor to determine if the equipment that the Contractor proposes to furnish will fit in the space. The drawings are not intended to show exact locations of pipes and ducts, or to indicate all offsets and fittings or supports, but rather to indicate approximate layout.

B. The mechanical, plumbing and fire protection Drawings are necessarily diagrammatic in character and cannot show every connection in detail in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. When the mechanical, electrical, plumbing and fire protection drawings do not give exact details as to the elevation of pipe, conduit and ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Exposed piping and ductwork is generally

intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

D. The locations, arrangement and extent of equipment, devices, and other appurtenances related to the installation of work shown on the Drawings are approximate. The Contractor shall not scale drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy for resolution.

E. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.10 ORDINANCES, PERMITS AND DRAWING APPROVALS

A. The Contractor shall file all requisite plans relating to this section of the specifications with the proper authorities, secure all permits and approvals and pay all resultant fees for work done under this section.

B. All fire protection work shall comply with all laws, ordinances, rules, regulations and standards of the City, County, State and the Owner's Insurance Underwriter; all applicable sections of the National Fire Codes and the Codes and Standards of the National Fire Protection Association.

C. If code or other requirements exceed the provisions shown on the Contract Documents, the Architect shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.11 SUBSTITUTIONS

A. The products described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. See division 01 specification for additional requirements.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least **seven (7)** days prior to the date for receipt of proposals. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

C. The Architect and Owner reserve the right to disapprove the use of any manufacturer who in their judgment is unsuitable for use on the Project and that decision will be final.

D. **No substitutions will be considered after the Award of Contract.**

E. Requests for Substitutions: Submit three (3) copies of each request for substitution. In each request identify the product or fabrication or installation method to be replaced by the substitution; include related Specifications Section and Drawing numbers, and complete documentation showing compliance with the requirements for substitutions. Include, as appropriate, with each request, the following information:
   1. Product data, drawings and descriptions of products, fabrication and installation procedures.
   2. Samples, where applicable or requested.
   3. A detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect, where applicable.
   4. Coordination information, including a list of changes or modifications needed by other parts of the work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   5. A statement indicating the effect the substitution will have on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   6. Cost information, including a proposal of the net change, if any in the Contract Sum.
   7. Certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal-to or better than the work required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
   8. A statement indicating the Contractor will reimburse the Owner and pay for all costs, including Architect/Engineer's re-design and evaluation costs resulting from the use of the proposed substitution

F. Condition: The Contractor's request for substitution will be received and considered when extensive revisions to Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request is timely, fully documented and properly submitted, and when one (1) or more of the above conditions are satisfied, all as judged and determined by the Architect/Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

1.12 SUBMITTALS

A. Provide shop drawings and complete product data as indicated in each specification section.

B. Coordination Drawings: Using the mechanical ductwork shop drawings as a basis, provide a composite set of AutoCAD drawings in which the major mechanical, plumbing and fire protection equipment, ductwork and piping are superimposed on the architectural reflected ceiling plan and structural framing plan. Include spot elevations of bottom of steel along with finished ceiling height. Prepare at 1/8 inch scale or larger, one drawing per building area. Provide 1/4 inch scale enlargements of locations where special attention to rough-in dimensions as required to ensure all systems will fit within the available space.

C. Shop Drawings will be reviewed and returned to the Contractor with one of the following categories:
   1. **Reviewed**: No further submittal action is required. Submittal to be included in O & M Manual.
   2. **Revise and Resubmit**: Contractor to resubmit submittal as indicated in comments section of Engineer's Submittal Cover Letter.
   3. **Rejected**: Contractor to resubmit new submittal when alternate or substitution is not approved and be required to furnished product named in Specification and or Drawings.
   4. **Furnish as Corrected**: Contractor to submit letter verifying that required corrections noted on Engineer's Submittal Cover Letter have been received and complied with by manufacturer. If equipment on site is not in compliance with corrections noted, contractor shall be responsible for the cost of removing and replacing equipment.

D. Materials and equipment which are purchased or installed without Submittal review and approval will be removed and replaced with specified equipment at Contractor's expense.

E. Provide a specification review that consists of a copy of related specification section with notations indicating compliance or deviation with each element of specification.

F. All approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to equipment being submitted to the Engineer.

G. Review of submittals by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as roof openings, wall openings, electrical characteristics, etc.

H. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

I. Submittals shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any proposed deviations from specified equipment shall be clearly indicated on the submittal.

1.13 CLOSEOUT SUBMITTALS

A. Submit in accordance with Division 1 - General Requirements and each specification section.

1.14 INTERFERENCE DRAWINGS

A. Where field conditions prohibit the installation of the mechanical, plumbing or fire protection system components within the available space as indicated on drawings, the Contractor shall prepare a sketch to the minimum 1/8 inch scale, clearly depicting the conflict along with an alternate installation arrangement that satisfies the design intent of the documents without incurring additional cost.

B. Obtain written approval of proposed interference resolution prior to proceeding with alternate installation.

1.15 EQUIPMENT, MATERIALS, BID BASIS

A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in the Specifications or on the Drawings as "base" products.

C. "Equal product" and "approved equal" items listed shall conform to specified base items and shall be substantially equal in size, weight, construction quality and capacities. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question.

D. The Contractor shall coordinate the installation of all fire protection equipment proposed for use in this project with all building trades (architectural, structural and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost.

1.16 PRECONSTRUCTION CONFERENCE

A. The Contractor shall schedule a meeting including the sprinkler sub-contractor, Owner, Architect and Engineer prior to the installation of any fire protection pipe hangers.

1.17 TRANSPORTATION, DELIVERY, STORAGE AND PROTECTION

A. The Contractor shall provide and pay for all transportation, delivery, and storage required for all equipment and materials. Upon receipt of all equipment and materials, they shall be properly stored in their original shipping container to protect them from vandalism, theft, the elements, and other harm or damage. Any equipment or materials received in a damaged condition, or damaged after receipt, shall not be installed. Only new undamaged equipment in first-class operating condition shall be installed.

B. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

C. The Contractor shall closely coordinate the ordering and delivery of all mechanical equipment with other trades to assure that equipment will be delivered in time to be installed in the building without requiring special or temporary access or building modifications. Certain equipment may have to be installed prior to the erection of the building walls or roofs.

1.18 GUARANTEE

A. All fire protection work described in the Contract Documents shall be guaranteed for a period of one (1) year from the date of final acceptance. This guaranty shall apply to all equipment, materials and workmanship. During the guaranty period, all defects shall

be corrected in an acceptable manner, consistent with the quality of materials and workmanship of original construction, at no expense to the Owner.

1.19 SPARE EQUIPMENT

A. The Contractor shall furnish and install a cabinet located in the fire service entry room with the quantity of each type of sprinklers and wrenches as required by NFPA 13:
   1. Facilities with less than 300 sprinklers – 6 minimum
   2. Facilities with 300 to 1000 sprinklers – 12 minimum
   3. Facilities with over 1000 sprinklers – 24 minimum

1.20 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.

B. The original set of “as-built” drawings shall be scanned and transmitted to the Architect in both full size bond and PDF format.

C. As Build Drawings: 2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each, PDF Format and AutoCad 2015 files on disk (CD Rom).
   1. Number of Copies: Submit one set of marked up record prints.
   2. Number of Copies: Submit copies of record Drawings:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Submit record digital data files and one sets of plots.
         3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit PDF electronic files of scanned record prints and three sets of prints.
         2) Submit record digital data files and three sets of record digital data file plots.
         3) Plot each drawing file, whether or not changes and additional information were recorded.

D. As-Built drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents
   2. Remove Engineer’s seal, name, address and logo from drawings.
   3. Mark documents AS-BUILT DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY.
   5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
   6. Indicate exact location of all underground plumbing and flow line elevations.
   7. Indicate exact location of all underground mechanical piping and elevations.
   8. Indicate exact location of all underground electrical raceways and elevations.
   9. Correct schedule to reflect (actual) equipment furnished and manufacturer.

10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
12. Exact location of all electrical equipment in and outside of the building.
13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
15. Cloud all changes.

1.21 START-UP-SERVICE

A. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and start-up of all major equipment and systems including booster pumps, water heaters, sewage ejectors, lift stations, fuel oil systems, etc. A formal report is to be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the operator's personnel shall be provided following certification of the assembly.

1.22 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Prior to final acceptance by the Owner, the Contractor shall provide three (3) copies of an Operations and Maintenance Manual, Bound, indexed, and titled in three-ring, loose-leaf binders. These manuals shall each contain the following:

1. Clear and concise instructions for operation, maintenance, adjustment, lubrication, wiring diagrams and trouble-shooting data for all mechanical equipment. This information shall be prepared by the manufacturer for particular size and model of equipment furnished.
2. Parts list of all parts for equipment, with catalog numbers and other data necessary for ordering of replacement parts.
3. Provide a competent manufacturer's service engineer for a minimum of two (2) days to instruct the operating personnel including the interpretation of all equipment diagrams. A diary of the training sessions shall be made by the instructing manufacturer's service engineer and witnessed by the Owner's representative and shall be included in the as-built submittal.
4. Copies of all approved equipment shop drawings, sprinkler layout drawings, hydraulic calculations and as-built plans shall be submitted with the Operation and Maintenance manual.
5. Index shall include type of equipment, manufacturer, and local representative with address and phone number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All sprinkler system equipment is to be UL Listed or FM Approved.

2.2 ACCESS PANELS

A. Group valves together above suspended ceilings, walls, furred spaces to minimize the number of access panels, but with all valves freely accessible for maintenance. Locate all valves within 1'-0" of access point.

B. Furnish access panels of proper size to service concealed valves and cleanouts. Panels shall be of the proper type for material in which they occur and are to be furnished by the Contractor, but installed by the particular trade for the material within which the access panel is installed.

C. Panels shall have flush doors with No.16 USCG steel door and trim No. 16 USCG steel frame, metal wings for keying into construction, concealed hinges, and screwdriver operated stainless steel cam lock. Panels shall be shop coated with one coat of zinc chromate primer. Valves above removable ceilings shall have tile clips by the Contractor for identification.

D. Access panels are not allowed in gypsum ceilings in public spaces.

2.3 FLOOR, WALL & CEILING PLATES

A. Furnish and install heavy gauge chromium plated steel wall and ceiling plates on all exposed pipes in finished areas where they pass through walls, ceilings, etc. Plates shall be of type that will remain permanently in position and where pipes are insulated they shall be of size necessary to cover insulated pipe.

2.4 GALVANIC PROTECTION

A. Insulate joints between dissimilar metals with suitable isolation gasket and bolts with fiber ferrules and washers and/or suitable armored insulation fittings by Clearflow, Crane, Capital, or Epco, so there will be no contact between the metals or with insulating bushings

2.5 INSULATION

A. The following shall be insulated:
   1. All fire suppression water piping above grade (outdoor).
   2. All fire suppression water piping above grade (un-condition space).
   3. Acceptable manufacturers:
      a. Manville Corporation.
      b. Certain-Teed.
      c. Owens Corning Fiberglass.
      d. Knauf Insulation.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral-Fiber, Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type I, with factory-applied, all-purpose, vapor-retardant jacket.
2. Blanket Insulation: Comply with ASTM C553, Type II, without facing.
3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades
   a. Class I, Grade A for bonding glass cloth and tape to un-faced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to un-faced glass-fiber insulation.
   b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
   c. Class 2, Grade A, and comply with MIL-A-3316C. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Vapor-Retarder Mastics: Fire and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C 19565C, Type II. For indoor applications, use mastics that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

F. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class I.
2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.

G. Field-Applied Jackets:
1. General: ASTM C 921, Type I, unless otherwise indicated.
2. Foil and Paper Jacket: Not acceptable.
3. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
   a. Adhesive: As recommended by insulation material manufacturer. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. PVC Jacket Color: White.
   c. PVC Jacket Color: Color-code piping jacket as determined by existing conditions.
   d. Not to be used for outdoors.
4. Heavy PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil (0.75 mm) thick, high-impact, ultraviolet-resistant PVC.
   a. Shapes: 45 and 90-degree, short and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
   b. Adhesive: As recommended by insulation material manufacturer. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   c. Not to be used for outdoors.
5. Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.
   a. Finish and Thickness: Smooth finish, 0.010 (0.25 mm) inch thick.

b. Moisture Barrier: 1-mil thick, heat-bonded polyethylene and kraft paper.
c. Elbows: preformed 45 and 90-degree, short and long-radius elbows; same material, finish, and thickness as jacket.

6. Joint Sealants: For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Accessories and Attachments
1. Bands: stainless steel ASTM A666, Type 304, 3/4 inch (20 mm) wide; 0.02 inch (0.050 mm) thick.

I. Vapor Retardants
1. Mastics: Use materials as recommended by the insulation material manufacturer that are compatible with insulation materials, jackets, and substrates. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II. For indoor applications, use mastics that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

2.6 HEAT CABLE FOR FREEZE PROTECTION OF PIPING

A. Provide electric heat tracing on all domestic water piping and sanitary traps exposed to areas subject to freezing.

B. Provide a complete UL Listed, CSA Certified, or FM Approved system of heating cables, components, and controls to prevent pipes from freezing.

C. Electric heat cable shall be installed linearly along the bottom of the pipe and allowance shall be made for all fittings, valves, pipe supports, etc. Cable shall be installed prior to insulation of the piping system.

D. Electric cable shall be capable of maintaining a minimum water temperature of 40 degrees F at an ambient air temperature of 0 degrees F.

E. The electric cable shall be the self-regulating type that responds to varying localized temperature conditions by varying the heat output along its length. This shall be accomplished by a self-regulating core, which varies its resistance continuously with changes in temperature. A constant wattage heater is unacceptable.

F. Provide a thermostat control, which de-energizes the heating cable when the ambient air temperature is above 40 degrees F (adjustable). The heat cable shall be entirely self-regulating while energized.

G. Provide all power connection hardware, splices, end seals, etc., to accomplish installation. All hardware shall be by the same manufacturer as the cable.

H. Electric heating cable and accessories shall be UL Listed. Electric heating cable shall conform to all requirements of Division 26 - Electrical Requirements.

I. Electric heating cable shall be Raychem XL-Trace or approved equal, 5 watts per foot.

J. All piping shall be insulated with 1" thick fiberglass insulation.

K. Heating-cable circuit shall be protected by a ground-fault device for equipment protection. This requirement is in accordance with section 427-22 of the NEC-2002.

L. All heating cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable.

2.7 PIPING SYSTEMS IDENTIFICATION

A. A marker showing the service and an arrow indicating the direction of flow shall be applied on the following equipment installed under this section of the Specifications:

1. All above ground fire protection standpipe and sprinkler piping
2. All above ground sprinkler drainage piping

B. A marker showing the service and an arrow indicating the direction of flow shall be applied on all of the following piping systems applicable to the project installed under this section of the Specifications:
1. Sprinkler piping
2. Drain piping
3. FDC piping

C. Piping identification shall be applied on all piping systems in areas of exposed construction and in areas with accessible or lay-in ceilings. The piping shall be labeled at each wall and floor penetration (both sides), and at connections to equipment. In addition, straight runs of piping shall be labeled at intervals not greater than 25 feet.

D. The letter size and background color shall conform to the Identification of Pipe System ANSI A-13-1. The vinyl plastic markers shall be as manufactured by Seton Name-Plate Company, W. H. Brady Company, or Westline products.

E. Each valve in the Plumbing and Fire Protection systems is to be provided with an individually numbered valve tag (stamped numbered tags). Provide Identification Tags on all Emergency fixture and unit or Shut off valves.

F. Valve tags are to be brass or plastic laminate, 1-1/2" minimum diameter with brass chain and hook for securing to the valve.

G. Valve tags will include a “P” or “FP” lettering designation to indicate the appropriate system. Numbering shall be consecutive for each service of either the Plumbing or Fire Protection systems. All valves on pumps shall be similar to the valve tags specified above, except they shall be 2-1/2" in diameter, black with white number 2" high for attaching to valve stem by means of brass hook or small solid link brass chain. Tags shall be similar to Seton 2961-25.

H. A printed list or schematic drawing shall be compiled for each system indicating the location and detailed description of the system or equipment served.

I. One copy of each list shall be framed and mounted at the location designated by the Building Engineer. An additional copy of each list is to be included in the Operations and Maintenance Manual.

2.8 EQUIPMENT LABELING

A. All equipment shall be labeled. This shall include all pumps, water heaters, storage tanks, and other similar equipment.

B. Equipment labeling shall be one of the following, unless noted or specified otherwise.

1. Permanently attached plastic laminate signs with 1" high lettering.
2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

2.9 PAINTING

A. All piping exposed to public sight such as standpipe and drain piping in stairwells, or exposed to exterior or moisture conditions such as piping in parking decks, shall be primed and painted with two coats of an enamel-based paint. The color shall be as directed by the Architect.

B. All piping exposed to corrosive environment such as pool areas, pool equipment room, sanitization room, and acid room shall be primed and painted with two coats of an enamel-based paint. The color shall be as directed by the Architect

C. Contractor shall touch-up to match original finish any equipment scratched in shipment or installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for conditions under which work is to be performed. Report in writing to the Architect all conditions that will adversely affect satisfactory execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Drawings are diagrammatic and the final arrangement of the work shall suit field conditions, the characteristics of the materials used and coordination with all other disciplines and the building components and finishes. Verify all dimensions in the field. Access and clearances must be provided and maintained for the proper operation, maintenance service and repair of the work.

B. **At all locations where ceiling mounted projectors are to be installed**, allow for all adjacent ceiling tiles to the proposed projector location to be left clear with no devices or equipment installed to allow relocation of the projector mount, projector power and data connection to be relocated to any of the adjacent ceiling tiles. The tiles shall encompass the distance of 6 to 10 feet from the projector screen.

C. Sprinkler piping that is exposed (such as in stairwells, etc.) shall be designed such that it is tight to a building element and shall be located minimum 8’ above finish floor so that students do not hang on it.

D. Fire sprinkler piping shall be installed a minimum of 12” away from the domestic cold and hot water piping.

E. No sprinklers are to be installed prior to the building being completely sealed in from external moisture and conditions.

F. All standpipe, sprinkler and drain piping exposed to sight in stairwells is to be painted with two coats of an epoxy based paint, color to be selected by the Architect.

G. All equipment and materials shall be installed according to manufacturer's recommendations and shall meet the requirements of NFPA and the Owner's Insurance Underwriter.

H. All sprinklers in spaces visible to public view shall be located symmetrically in relation to ceiling design elements, lighting fixtures, speakers, diffusers, etc. All ceiling components are to be indicated on the submittal drawings as noted previously to ensure coordination with all ceiling elements and devices. Piping to sprinklers in these areas is to be provided with arm-overs to allow for exact placement of sprinklers.

I. Sprinklers shall be installed at the centerpoint of all 2' x 2' lay-in ceiling tiles, and at the centerpoint or 1' from the ends of 4' x 2' ceiling tiles.

J. Where pipe is installed above suspended ceilings, it shall be located in the clear space above the suspended ceiling and the pendent sprinklers shall be located to clear the ceiling supporting grid system, the ceiling mounted fixtures, and air conditioning ducts and outlets.

K. The Contractor shall install additional pendent sprinkler heads under all ductwork or other obstructions which are over 48" wide in accordance with NFPA-13 in areas of exposed construction.

L. Provide a pressure gauge at the top level of all standpipes.

M. Provide tracer wire on all pipe installed below slab outside building; locate leads in accessible location for future use in trouble shooting.

N. Horizontal branch piping shall be pitched to mains per NFPA. Locate all sprinkler mains a minimum of 24" above any finished ceiling.

O. Hydraulic information placards with permanent markings indicating the hydraulic design criteria for each separate system should be installed on each riser.

P. Provide basket type metal guards over sprinkler heads to protect them from damage in mechanical rooms, main electrical and telephone equipment, storage rooms and all unfinished areas where the head is less than 7 feet-6 inches above finished floor.

Q. All threads for fire department connections shall match the local Fire Department connecting threads and requirements.

R. Building shall be 100 percent fully sprinklered.

S. Sprinkle Zones shall comply with NFPA 13, for areas limitations, provide a minimum of TWO sprinkler systems with separate alarm check valve assemblies.

T. Fire Alarm System: Coordinate with Division 26 to provide connections to all supervised devices and flow switches as well as any other items requiring connection to the fire alarm system, provide all wiring and equipment.

U. Stages: At each side of each stage provide a complete Authorities having Jurisdiction and NFPA compliant class III standpipe system with 1.5” and 2.5” fire department hose connections. Mount hose connections in Potter-Romer lockable, clear glass front cabinet. Coordinate exact location of standpipes with stage equipment.

V. Maintain a minimum 3’ horizontal separation between any recessed, pendant sprinkler head and any wall, partition, furr-down, or other vertical surface.

W. Provide protection in all gymnasium areas.

X. If a deluge system in required, the system shall be installed so that the deluge system will not engage during a fire drill and/or in fire test mode.

3.3 PREPARATION

A. Arrangements shall be made to have the openings, inserts, sleeves, blockouts, and such other incidentals set in place ahead of the construction work, where practical, to eliminate the need of cutting and patching. If coring becomes necessary for installation of the work, it shall be done under this section. All holes shall be neatly patched and finished to match the adjoining work in a manner approved by the Architect. All coring shall be performed in a manner not to weaken the structural parts and the manner and method shall be submitted to the Structural Engineer for approval.

3.4 SLEEVES AND ESCUTCHEONS

A. The Contractor shall furnish and set pipe sleeves and inserts for all work under this section and shall be responsible for their proper and permanent location. In the event that failure to do so requires cutting and patching, the remedial work shall be the responsibility of the Contractor.

B. All pipes passing through floors, walls or partitions shall be provided with sleeves having an internal diameter 1-1/2" (3/4" annular space) larger than the outside diameter of the pipe or insulation on covered lines, except as otherwise specified herein.

C. Sleeves for all pipes through walls, beams and partitions shall finish flush with the finish line of the walls, beams and partitions.

D. Sleeves for all piping shall extend 1/2" above finish floor, (except where under partitions, the sleeves shall be flush with the bottom of the partition) and after the installation of pipe shall be packed and made watertight with fire stopping sealant to maintain separations and fire ratings.

E. Where pipes pass under footings and through exterior walls, sleeves shall be of galvanized steel pipe and shall be not less than 4" larger than the pipe being sleeved. Sleeves shall be made watertight where passing through waterproofed surfaces, exterior wall, and floor slabs on grade. Waterproofing shall be done by means of a steel slip on welding flange, continuously welded at the center of the sleeve and shall be painted with one coat of bitumastic paint inside and outside. The space between sleeve and pipe shall be packed with oakum to within 2" of each face of the wall; (to within 2" of the top of sleeve at floors). The remaining space shall be packed and made watertight with a waterproof mastic. Mechanical expansion type rubber seals such as manufactured by Calpico Ind. and Thunderline Corporation are acceptable as alternate method of water proofing piping penetrations.

F. Sleeves through floors or interior masonry walls shall be of galvanized steel pipe or wrought iron pipe size except where located in concealed pipe spaces where they may be of 22 gauge galvanized sheet steel if fire rating is maintained.

G. Sleeves through interior masonry partitions shall be of 22-gauge galvanized sheet steel.

H. Sleeves for piping to receive insulation shall be large enough to allow continuous insulation through sleeves.

I. Spacing between or location of pipe sleeves in floor slabs, structural beams or structural walls shall be subject to the Structural Engineer's approval.

J. Where pipes pass under load bearing footings they shall pass through a coated steel pipe sleeve as described above and extend past a 45 degree line out from the bottom of the load bearing structure. Concrete shall be used as backfill in the portions of trench within the 45 degree pressure line.

K. Escutcheons shall be provided around all exposed pipe passing through walls, partitions, ceilings and floors in finished spaces. Escutcheons shall be of sufficient outside diameter to cover the sleeve opening and shall fit snugly around the insulated or bare pipe and to the wall, partition, floor or ceiling.

L. Supply piping (domestic and /or fire water) shall not pass under footings or through grade beams unless noted otherwise.

3.5 CLEANING

A. The entire underground and above ground sprinkler system shall be cleaned and flushed in accordance with NFPA 13, 24, 25.

B. Capped connections shall be located at the ends of sprinkler main piping to facilitate flushing and cleaning of systems.

C. Remove all trash and debris from site and dispose of legally.

D. All equipment shall be thoroughly cleaned and left in a satisfactory condition for proper operation at project completion. All equipment shall be partially or fully re-painted as required to provide an appearance of new equipment.

3.6 DEMONSTRATION

A. To obtain complete and final acceptance of the fire protection system, all inspections, approvals, examination and acceptance tests required by the Authority Having Jurisdiction shall be arranged and paid for under this Section.

B. Sprinkler Contractor shall provide necessary equipment and test materials for testing of the installation.

C. Testing of the completed sprinkler system for acceptance shall be witnessed by an Owner's representative. Testing should be coordinated with the Authority Having Jurisdiction.

D. Provide the Owner with as-built drawings and equipment data at completion of construction. As-built drawings shall include an overall graphic drawing of areas

covered by each sprinkler zone. This is to include auxiliary drains and inspector test locations. This is to be updated and displayed at riser room. New graphic to include existing systems.

E. Complete set of as-built drawings (Per NFPA) to be provided to document box at FACP. Drawings to include hydraulic calculation plate information. As-built to be provided in cad and PDF formats to district.

F. Zone calculation plates to be permeant type (metal or laminate) with printed information attached to each riser.

G. Provide completed Underground and Aboveground Contractor's material and Test Certificates per NFPA 13 at time of acceptance of test.

H. Inspections test to be piped into nearest drain to support flow.

3.7 PAINTING

A. Where exposed in any MEP equipment room, all fire protection piping shall be painted red.

B. Paint prior to the installation of sprinkler heads; replace any sprinkler heads that come in contact with paint with new heads.

3.8 WORKMANSHIP

A. All work shall be coordinated with the work to be performed or installed under other sections of these Specifications.

B. All work shall be executed in a workmanlike manner by workmen skilled in this type of work and shall present a neat appearance when completed.

C. Offsets shall be provided as required to avoid interference and conflicts with other work, to maximize headroom, or to improve the appearance of pipe runs. All pipe supports, structural members, hangers and other apparatus necessary to support firmly and substantially the various components of the systems shall be provided under this section.

D. Nameplates, catalog numbers and rating identifications shall be securely attached to equipment with screws or rivets. Adhesives or cements will not be permitted.

E. The subcontractor shall be responsible for the protection of the work from injury and shall protect all apparatus with suitable enclosures.

3.9 ERECTION AND INSTALLATION

A. Installation and workmanship requirements are specified hereinafter.

B. This subcontractor shall be responsible for the furnishing and installing of all support steel, hangers, rods, clamps, etc., to provide adequate support of all Fire Protection equipment specified herein. All support assemblies shall be UL Listed or FM Approved.

3.10 TESTS

A. Tests of all fire protection systems and equipment, underground and inside piping including alarm and detection devices shall be scheduled with one (1) week prior notification to a local representative of the Underwriter and the Architect. All tests and test procedures shall be in accordance with the applicable NFPA standards. After completion of all tests, the “Contractor’s Materials and Test Certificate” shall be submitted to the Architect.

B. The Contractor shall supply all materials, labor, utilities and power required for testing. Preliminary tests shall be performed to prove work is satisfactory prior to requesting a test inspection. Sectional tests shall be made before insulation or concealing any piping.

C. Repair all defects disclosed by tests or, if required by the Architect, replace defective work with new systems and materials at no additional cost to the Owner. Repairs to piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Make tests in stages to facilitate work of others.

D. The Contractor shall be responsible for the repair and/or replacement cost installed and finishes damaged by leaks, tests and/or repair and replacement of his work at no additional expense to the Owner.

E. Prior to final acceptance by the Owner, submit the “Contractor’s Material and Test Certificates” indicating system compliance with all applicable sections of NFPA.

3.11 INSTRUCTION OF OWNER’S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
   1. Provide the training during the Owner's regular working day.
   2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 8 hours dedicated instructor time.
   2. 4 hours on each of 2 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
   1. One copy to the Owner.
   2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, arid the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operation and Maintenance Manual":

3.12 OPERATION AND MAINTENANCE MANUALS

A. Form of Manuals:
   1. Prepare data in form of an instructional manual for use by Owner's personnel.
   2. Format:
      a. Size: 8-1/2" x II".
      b. Text: Manufacturer's printed data or neatly typewritten
   3. Drawings:
      a. Provide reinforced punched binder tab and bind in text.
      b. Fold larger drawings to size of text pages.
   4. Provide fly leaf indexed tabs for each separate product or each piece of operating equipment
   5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
      a. Title of Project
      b. Identity of separate structures as applicable.
      c. Identity of general subject matter covered in the manual
   6. Binder as specified.

B. Content of Manual:
   1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
      a. Contractor, name of responsible principal, address and telephone number.
      b. A list of each product required to be included, indexed to content of the volume.
      c. List with each product, name, address and telephone number of:
         1) Subcontractor or installer
         2) Maintenance contractor as appropriate.
         3) Identify area of responsibility of each
         4) Local source of supply for parts and replacement
      d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
   2. Product Data:
      a. Include those sheets pertinent to the specific product.
      b. Annotate each sheet to:
         1) Identify specific product or part installed.
         2) Identify data applicable to installation.
         3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner).
   3. Drawings:
      a. Supplement product data with drawings as necessary to illustrate:
         1) Relations of component parts of equipment and systems.
         2) Control and flow diagrams.
      b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
      c. Do not use Project Record Documents as maintenance drawings.

4. Written text, as required to supplement product data for the particular installation:
   a. Organize in consistent format under separate headings for different procedures.
   b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued.
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure.
      2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts
   b. Operating procedures:
      1) Start up, break-in, routine and normal operating instructions.
      2) Regulation, control, stopping, shut down and emergency instructions.
      3) Summer and winter operating instructions.
      4) Special operating instructions
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting.
      3) Disassembly, repair and reassembly.
      4) Alignment, adjusting and checking.
      5) Routine service based on operating hours.
   d. Servicing and lubrication schedule. List of lubricants required.
   e. Manufacturer's printed operating and maintenance instructions.
   f. Description of sequence of operation by control manufacturer
   g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Predicted life of part subject to wear.
      2) Items recommended to be stocked as spare parts.
   h. As installed control diagrams by controls manufacturer.
   i. Complete equipment internal wiring diagrams.
   j. Each Contractor's coordination drawings.
   k. As installed color coded piping diagrams.
   l. Charts of valve tag number, with location and function of each valve.
   m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
   n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 23.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide backflow preventer certified test reports.

END OF SECTION 21 05 00

SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE PROTECTION.

C. SECTION 21 05 48.13 - VIBRATION CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

D. SECTION 21 11 13 – FIRE SUPRESSION SYSTEMS.

E. SECTION 21 30 00 - FIRE PUMPS AND EQUIPMENT

F. SECTION 28 31 00 - FIRE DETECTION AND NOTIFICATION SYSTEMS.

1.2 DESCRIPTION

A. This section describes the following:
1. Hangers, supports and anchors fir the fire protection equipment, tanks and piping systems.
2. Supplementary steel for support or attachment of fire protection tanks, equipment and piping to general construction elements of the project.

1.3 REFERENCES

A. General:
1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

B. Code of Federal Regulations 29 CFR 1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL).

C. National Fire Protection Association (NFPA):
1. NFPA-13 Installation of Sprinkler Systems.
2. NFPA-14 Installation of Standpipe and Hose Systems.

D. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA):
1. Seismic Restraint Manual: Guidelines for Mechanical Systems - latest edition for the support of ductwork.

E. UL Fire Resistance Directory, latest edition.

1.4 SUMMARY

A. Provide a complete system of pipe hangers and supports for all plumbing and fire protection equipment and piping.

B. Section Includes:
1. Pipe, duct, and equipment hangers and supports.
2. Anchors, equipment bases and supports.
3. Sleeves and seals.
4. Flashing, counter flashing and pipe stacks.
5. Firestopping.

1.5 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.6 SUBMITTALS

A. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

B. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

C. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Submit calculations showing compliance with Division 01 Section "Lateral Force Procedures" for seismic bracing of ductwork and piping.

1.7 QUALITY ASSURANCE

A. Comply with Division 21 Section "Common Results for Fire Suppression."

B. Supports for Sprinkler Piping: Comply with NFPA 13.

C. Supports for Standpipes: Comply with NFPA 14.

D. Do not use black steel devices, components, fasteners, etc. within the Clean Room interstitial space or in any related air flow path. Steel items shall be plated, galvanized, painted, or coated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees Fahrenheit.

B. Maintain this minimum temperature before, during, and for minimum three (3) days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Unistrut Corp.
2. B-Line Systems.
3. Grinnell.
4. Superstrut,
5. Anvil.

B. Pipe Supports:
1. Conform to MSS SP58.
2. Hangers for Pipe sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel ring, UL listed, Grinnell Fig. 69 or equal. Use plastic coated hangers at all uninsulated copper piping.
3. Hangers for Pipe sizes two (2) inches and Larger: Carbon steel, black or galvanized, adjustable, clevis, UL listed, Grinnell Fig. 260 or equal.
4. Multiple or Trapeze Hangers: 12 gauge (2.67 mm) channel complete with nuts, pipe clamps, pipe straps, and drive-in end caps. Furnish cushion strip on all uninsulated copper piping and; cast iron roll and stand for hot pipe sizes 6 inches and over.
5. Pipe Supported Tight to Wall, Floor, or Ceiling: Superstrut A1200, Unistrut P1000, or equal, 12 gauge channel complete with pipe clamps, nuts, bolts, and end caps. Furnish cushion strip on all uninsulated copper piping and adjustable steel yoke and cast iron roll for hot-pipe sizes 6 inches and over.
6. Vertical Support: Steel riser clamp, UL listed, Grinnell Fig. 261, Superstrut C720, or equal.
7. Floor Support for Pipe Sizes to 4 Inches (101.6 mm) and Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
8. Floor Support for Hot Pipe Sizes 6 Inches (152.4 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
10. CPVC Tube Support: CTS sized hangers or supports free of sharp edges.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 ATTACHMENT TO STRUCTURE

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

B. Connection to Existing Concrete Structure: Concrete anchors conforming to Division 03 Section “Concrete Accessories”.

C. For Suspension from New Formed Concrete Structure: B-Line B3014, Grinnell Figure 282, Superstrut 452, or equal, adjustable concrete insert.

D. For Support on New Concrete: Galvanized steel headed bolts.

E. Welded Connection to Steel Beams: B-Line B3083, Grinnell, Superstrut, or equal, steel welded beam attachment.

F. Clamp Connection to Steel Beams: B-Line, Grinnell, Superstrut, or equal, beam clamp with retaining clip style as required by load.

2.4 SUPORTS, BRACING, AND ACCESSORIES

A. Miscellaneous Steel: Angles, channels, brackets, rods, clamps, etc., of new materials conforming to ASTM A36. Hot-dip galvanize all steel parts after fabrication where used outdoors or inside the penthouse.

B. Fasteners: All bolts and nuts, except as otherwise specified, shall conform to ASTM Standard Specifications for Low Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307. Bolts shall have heavy hexagon heads, and nuts shall be of the hexagon heavy series. All bolts, washers, nuts, anchor bolts, screws and other hardware used outdoors or inside the penthouse shall be galvanized, and all galvanized nuts shall have a free running fit. Provide bolts of ample size and strength for the purpose intended. All ferrous metal components below grade shall be stainless steel.

C. Sheet Metal Screws: Plated, size 10 minimum.

D. Pre-engineered duct and pipe bracing systems may be Mason Industries Seismic Sway Brace System or equal.

2.5 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors and Walls: 18 gage thick galvanized steel.

B. Provide chrome plated escutcheon plates on pipes passing through walls, floors, and ceilings exposed to view. Provide stainless steel sheet metal for exterior walls.

C. Sealant: Acrylic

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc., or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:
1. Unistrut Corp., or approved equal.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.8 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp. Model.
2. 3M fire Protection Products Model.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray Black As selected from manufacturer’s full range of colors.

D. Plastic Tube and Pipe: Ensure that the appropriate firestop assembly is used for plastic piping systems. Refer to manufacturer’s system selector for more information.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
1. Mineral fiberboard.
2. Mineral fiber matting.
3. Sheet metal.
4. Plywood or particle board.
5. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
1. Furnish UL listed products or products tested by independent testing laboratory.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials to arrest liquid material leakage.

D. Do not drill or cut structural members.

E. Do not crush insulation with pipe clamp. Provide high density pipe insulation to accommodate pipe clamp or hanger.

F. Do not attach beam clamp on to bottom of steel joist.

3.2 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe four (4) inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 58.

B. Supports for Gas Piping:
1. Horizontal supports for steel and copper gas piping, threaded or welded, are every six (6) feet for 1/2 inch, every eight (8) feet for 3/4 inch and one (1) inch, and every ten (10) feet for 1-1/4 inches or larger.

2. Vertical supports for steel gas piping, threaded or welded, are every six (6) feet for 1/2 inch, eight (8) feet for 3/4 inch and one (1) inch, and every floor for 1-1/4 inch and larger.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with five (5) feet maximum spacing between hangers. Support hubless cast iron at every other joint unless over four (4) feet then support at each joint. Support copper every six (6) feet for 1-1/2 inch and smaller; every ten (10) feet for two (2) inches and larger.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation.

L. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

M. Support PEX tubing every 32 inches unless a continuous support such as Uponor PEX-a Pipe Support is used. Then:
1. ½ - ¾ inch pipe: 6 feet
2. 1 – 3 inch pipe: 8 feet

N. Install PEX tubing in accordance with the Uponor Plumbing Design Assistance Manual or the Uponor Professional Plumbing Installation Guide.

3.4 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors one (1) inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation or caulk. Firestopping required at all penetrations of rated floor and walls.

F. Install chrome plated steel escutcheons at finished surfaces.

3.5 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating. Refer to Architectural drawings for location of all rated walls and floors.

D. Fire Rated Surface:
   1. Seal opening at floor and wall as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

E. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
      b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
      c. Install type of sealant or caulk suitable for application.
   2. Install escutcheons where pipe, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

END OF SECTION 21 05 29

SECTION 21 05 48.13 - VIBRATION CONTROLS FOR FIRE-SUPPRESSION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE PROTECTION.

C. SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION SYSTEM

D. SECTION 21 11 13 – FIRE SUPRESSION SYSTEMS.

E. SECTION 21 30 00 - FIRE PUMPS AND EQUIPMENT

F. SECTION 28 31 00 - FIRE DETECTION AND NOTIFICATION SYSTEMS

1.2 DEFINITIONS

A. IBC: International Building Code.

1.3 PERFORMANCE REQUIREMENTS

A. It is the intent of this specification to provide vibration isolation supports for all equipment, piping and ductwork as may be required to prevent transmission of vibration to the building structure. It will be the Contractor's responsibility to select and install vibration isolators which will enable the noise criteria standards to be met, to the extent that the noise can be controlled by the vibration isolators.

B. All vibration isolation devices, including auxiliary steel bases and pouring forms, shall be designed and furnished by a single manufacturer or supplier.

C. Unless otherwise noted or scheduled, spring type vibration isolators shall be used for all equipment driven by motors of 0.5 HP and larger. Deflections as tabulated are minimums and it shall be the responsibility of the isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance in order to prevent the transmission of objectionable vibrations and meet the noise criteria referenced herein.

D. Unless otherwise noted, equipment driven by motors 0.25 HP and smaller shall be isolated by means of Type ND elastomeric mounts or Type HD elastomeric hangers properly sized for 0.35 inch deflection.

E. All elastomeric isolators shall be of high quality synthetic rubber with anti-ozone and anti-oxidant additives.

F. Design and treat vibration isolators for resistance to corrosion. Furnish phosphatized steel components with epoxy powder paint coating. Components exposed to the weather shall be

epoxy powder paint coated or hot-dipped galvanized. Furnish zinc electroplated nuts, bolts and washers. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

G. Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind loads of 30 lbs./sq.ft. Wind loading shall be applied to all exposed surface of the isolated equipment in order to identify worst case load.

H. All spring isolators shall be completely stable in operation and shall be designed for not less than 50 percent reserve deflection beyond actual operating conditions. All spring isolators must be completely stable in operation and have a Kx/Ky ratio of at least 1:1.

I. All isolation materials and flexible connectors shall be of the same manufacturer and shall be selected and certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor at no additional cost to the Owner. Manufacturer may purchase other manufactured products in order to meet this specification and shall guarantee outsourced product as a single point of responsibility. Outsourced products must be identified as such in the submittal for approval.

J. The contractor and manufacturer of the isolation and equipment shall refer to the isolator schedule which lists isolator types and isolator deflections.

K. Deflection table is based on maintaining rooms at the following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE and ANSI S1.8.
   1. Offices
      a. Executive: 30
      b. Conference rooms: 30
      c. Private: 35
      d. Open-plan areas: 35
      e. Computer/business machine areas: 40
      f. Public circulation: 40

   2. Schools
      a. Lecture and classrooms: 30
      b. Open-plan classrooms: 35

   3. Libraries: 25
   4. Theaters
      a. Theater: 25
      b. Stage house: 25
      c. Trap room: 25
      d. Orchestra pit: 25
      e. Rehearsal rooms: 25
      f. Teaching studios: 30
      g. Practice rooms: 30
      h. Ensemble rooms: 30
      i. Shop: 45

1.4 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, and layout as well as connection details.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating materials and dimensional data. All steel bases and concrete inertia bases shall be completely detailed. Include clearly outlined procedures for installing and adjusting the isolators.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

F. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate vibration isolation installation is complete and in accordance with instructions. Provide a copy of field report to Architect/Engineer.

H. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. All fire suppression systems vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATOR TYPES

A. All vibration isolators described in this section shall be the product of a single manufacturer. . Submittals and certification sheets shall be in accordance with Specification 1.3 of this section.
1. Manufacturers:
   a. Mason Industries
   b. Kinetics Noise Control
   c. Amber / Booth
   d. Vibration Eliminator

B. Type WSW: Two layers of 3/8-inch thick neoprene pad consisting of square waffle modules separated horizontally by a 16-gauge galvanized shim. Where the load bearing area of the equipment is not the same size/shape as the load bearing area/shape of the pad, load

distribution plates, minimum ¼" thick galvanized steel, shall be utilized to ensure the load bearing capacity of the pad is maximized. Pads shall be sized for approximate deflection of 0.12 inch to 0.16 inch.

C. Type ND: Neoprene mountings shall have minimum static deflection of 0.35 inch. All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes on the bottom and a tapped hole with a mounting bolt and washer shall be provided. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang. Where the load bearing area of the equipment or support structure is not the same size/shape as the load bearing area/shape of the pad, load distribution plates, minimum ¼" thick galvanized steel, shall be utilized to ensure the load bearing capacity of the pad is maximized.

D. Type SLF: Spring isolators shall be free-standing and laterally stable without any housing and complete with a steel-washer-reinforced molded neoprene cup of 1/4-inch neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have minimum additional travel to solid equal to 50 percent of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.

E. Type SLR: Restrained spring mountings shall have an SLF mounting as described in Specification 2.1 C, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2 inch shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position under outdoor equipment, there must be an internal isolation pad in addition to the friction pad on bottom.

F. Type HD: Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch thick neoprene element. The neoprene element shall have neoprene bushings projecting through the steel box. In order to maintain stability, the boxes shall not be articulated as clevis hangers.

G. Type 30N: Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch thick neoprene elements at the top and a steel spring as described in 2.1 C, seated in a steel-washer-reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability, the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

H. Type PC30N: Hangers shall be as described in Specification 2.1 F, but they shall be precompressed and locked at the rated deflection by means of a resilient up stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30-degree capability.

I. Type WBI/WBD: Horizontal thrust restraints shall consist of a spring element in series with a neoprene molded cup, as described in paragraph 2.1 C, with the same deflection as specified for the mountings or hangers supporting the unit. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4-inch movement at start and stop. The assembly shall be furnished with a rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit.

J. Type SLR-MT: Restrained air spring mountings shall be manufactured with upper and lower steel sections connected by a replaceable flexible DuPont Kevlar reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. Restrained air springs shall be within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2 inch {12mm} shall be maintained around restraining bolts and between the housing and the air springs so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Air spring systems shall be connected to a supplementary air supply compressor (supplied with the air spring system) through a Mason Industries air spring control panel and equipped with three leveling valves to maintain level within plus or minus 0.125". Air spring mounts are to be located between the supporting steel and the roof or the grillage and dunnage as shown on the drawings when there is no provision for direct mounting. Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician.

2.2 BASES

A. Type WF: A welded integral structural steel fan and motor base with NEMA standard motor slide rails and holes drilled to receive the fan and motor slide rails. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split-case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height-saving brackets shall be employed in all mounting locations to maintain a 1-inch operating clearance under base.

B. Type ICS: Vibration isolation manufacturer shall provide steel members welded to height-saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base. Members shall have sufficient rigidity to prevent misalignment of equipment.

C. Type RBMK. Vibration isolation manufacturer shall furnish structural steel concrete pouring forms for floating concrete bases. Wood formed bases, formed steel bases and sheet metal formed bases are not acceptable. Bases for split-case pumps shall be large enough to provide for suction and discharge elbows. Bases may be T or L shaped where space is a problem. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6 inches. The base depth need not exceed 12 inches unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2-inch bars welded in place on 6-inch centers running both ways in a layer 1-1/2 inches above the bottom. Forms shall be furnished with steel templates to hold the anchor bolt

sleeves and anchor bolts while concrete is being poured. Recessed height-saving brackets shall be employed in all mounting locations to maintain a 1-inch operating clearance under base.

2.3 FLEXIBLE PIPE CONNECTIONS

A. Type SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR: Flanged and threaded rubber flexible joints shall be peroxide cured EPDM throughout with Kevlar tire cord reinforcement. Substitutions must have certifiable equal or superior characteristics. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable. Sizes 1-1/2" through 14"shall have a ductile iron external ring between the two spheres. Sizes 16" through 24" may be single sphere. Sizes 3/4" through 2" may have one sphere, bolted threaded flange assemblies and cable retention. Minimum ratings through 14"shall be 250psi at 170°F and 215psi at 250°F, 16" through 24" 180psi at 170°F and 150psi at 250°F. Higher published rated connectors may be used where required. Safety factors shall be a minimum of 3/1. All flexible joints must be factory tested to 150% of maximum pressure for 12 minutes before shipment. The piping gap shall be equal to the length of the flexible joint under pressure. Control rods passing through 1/2"thick Neoprene washer bushings large enough to take the thrust at 1000psi of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the flexible joint rating without them. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.

2.4 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING ISOLATION

A. Horizontal Pipe Isolation: All pumped water, pumped condensate and refrigerant piping size 1-1/4 inch and larger within mechanical rooms and on pipe size 2 inch and larger outside mechanical rooms shall be isolated. Outside equipment rooms this piping shall be isolated for the greater of 50 feet or 100 pipe diameters from externally isolated equipment. For the first 3 support locations from externally isolated equipment provide Type 30N hangers or Type SLF floor mounts with the same deflection as equipment isolators. All other piping within the equipment rooms shall be isolated with the same specification isolators with a 1" inch minimum deflection. Install piping hangers at regular intervals according the pipe hanger schedule. Where floor supports are required, provide sufficient spring capacity to absorb expansion and contraction of piping, and yet to permit piping to function as a floating system. Size hangers for 200 percent rated load. Coordinate selection of piping supports with equipment supports to accommodate expansion and contraction without creating excessive stresses at equipment connections.

B. Pipe Riser Isolation: All vertical pipe risers 1-1/4 inch and larger, where specifically shown and detailed on riser drawings shall be fully supported by Type SW SLF isolators with brackets. Refer to details on Drawings. Steel spring deflection shall be 3/4 inch minimum. In locations where added deflection is required due to pipe expansion/contraction, the spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the riser in tension. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Provide Type SWS wall sleeves. In addition to submittal data requirements previously outlined, riser diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the piping system has been examined for excessive stresses and that none will exist in the design proposed.

3.3 INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03.

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Locate isolation hangers as near the overhead support structure as possible.

D. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

E. Install isolated inertia base frames and steel bases on isolator units as indicated so that a minimum of one (1) inch clearance below base will result when supported equipment has been installed and loaded for operation.

F. Install flexible pipe connectors to equipment supported by vibration isolation. Provide line size flexible connectors.

G. Comply with manufacturer's instructions for the installation and load application of vibration isolation materials and products. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation or shipment.

H. Install cables so they do not bend across edges of adjacent equipment or building structure.

I. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

J. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

K. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

L. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least **four** of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 21 05 48.13

SECTION 21 11 13 - FIRE SUPPRESSION SYTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE PROTECTION.

C. SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION SYSTEM

D. SECTION 21 05 48.13 - VIBRATION CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

E. SECTION 21 30 00 - FIRE PUMPS AND EQUIPMENT

F. SECTION 28 31 00 - FIRE DETECTION AND NOTIFICATION SYSTEMS.

1.2 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. Contractor shall include within his bid all materials and Work to provide standpipe and 100% sprinkler protection for all areas in new construction or for the entire smoke compartment affected by renovation work.

D. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Architect shall be notified of the discrepancy.

E. Interface all new flow and valve supervisory switches with building fire and smoke alarm systems.

F. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of all the project Division 21 specification sections.

1.3 WORK INCLUDED

A. Code compliance, research, design coordination, and installation or a complete and functional hydraulically calculated wet pipe sprinkler system that meets the approval and is in accordance with the requirements of NFPA Fire Protection Standards listed in

1.4 (a), Underwriters Laboratory (UL), all local and sate regulations, and these specifications.

B. Alarm devices including alarm valves, flow switches/pressure switches, tamper switches and coordination with Fire Alarm and Detection Contractor.

C. Shop drawings and calculations prepared and submitted in accordance with the requirement of all Authorities Having Jurisdiction.

D. All permits and approvals of the fire protection system.

1.4 SYSTEMS

A. Systems to be provided under the Fire Protection design section shall be as listed below. The connection point to the site utility service for the fire protection system shall be at 5'-0" from the exterior of the building unless specifically otherwise noted.

1. Pipes, fittings, and specialties
2. Standpipe systems
3. Automatic Sprinkler Systems

1.5 GUARANTEE

A. All fire protection work described in the Contract Documents shall be guaranteed for a period of one (1) year from the date of final acceptance. This guaranty shall apply to all equipment, materials and workmanship. During the guaranty period, all defects shall be corrected in an acceptable manner, consistent with the quality of materials and workmanship of original construction, at no expense to the Owner.

1.1 DESIGN STANDARDS

A. Fire Protection systems shall be designed and installed in accordance with the requirements of the most current version of the following codes, standards and design guides:

1. The International Fire Prevention Code
2. The International Building Code
3. National Fire Protection Association (NFPA) Standards:
    a. NFPA 101 - Life Safety Code
    b. NFPA 13 - Installation of Sprinkler Systems
    c. NFPA 14 - Installation of Standpipe and Hose Systems
    d. NFPA 25 - Inspection, Testing, and Maintenance of Water-based Fire Protection Systems

B. Factory Mutual (FM) Approval Guide

C. Underwriters Laboratories Inc. (UL)

D. Owner’s Insurance Underwriter Requirements

1.2 SYSTEM DESCRIPTIONS

A. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

B. Automatic Wet-Type, Class II Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

C. Automatic Wet-Type, Class III Standpipe System: Includes NPS 1-1/2 (DN 40) hose stations and NPS 2-1/2 (DN 65) hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

D. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 DESIGN CRITERIA

A. Any design documents issued to the contractor are for information only. The Contractor shall be responsible for all code research and obtaining all required flow test data and hydraulically designing a fire protection system that meets all applicable requirements. The Contractor shall arrange for, and conduct a flow test and coordinate its validity with the Authorities Having Jurisdiction.

B. Upon award of the Contract, a new flow test from the two (2) hydrants nearest the site service entry is to be performed by the Contractor to confirm the flow and pressure characteristics of the existing water service. The completed flow test data along with a utility service map of the area is to be forwarded to the Engineer for confirmation of the existing water service.

C. Where pre-design of the sprinkler system is required for submission for the building permit: The Fire Protection documents were prepared to be in compliance with all applicable codes and flow test data provided. The Contractor shall review all documents provided and report any modifications required to these documents to the Design Engineer during the shop drawing preparation stage.

D. All sprinkler heads in occupied areas are to be fast response type heads (155 degrees – 165 degrees Fahrenheit).

E. All occupied, heated spaces will be protected by wet sprinkler systems.

F. Inspector test valves will be protected by wet sprinkler systems.

G. Automatic sprinkler systems shall be designed to the available domestic water pressure available and shall be hydraulically calculated for the following design standards:
   1. NFPA 13 Systems

Area/ Usage	Hazard Classification	Density GPM/Sq. Ft.	Remote Area	Maximum Head Spacing	Interior Hose Stream
Public Spaces, Lobbies, Corridors, Offices, Restaurants, Lounges, Meeting Rooms	Light	.10	1,500 sq. ft.	130-200 sq.ft.	100 gpm
Dry Pipe System:	Light	.09	1,950 sq. ft.	130-200 sq.ft.	100 gpm
Mechanical Rooms, Electrical Rooms, Elevator Equipment Rooms, Maintenance/ Storage Rooms, Kitchen/ Food Service Areas and Laundry	Ordinary Group 1	.15	1,500 sq. ft.	130 sq. ft.	250 gpm
Dry Pipe System: Parking Garages, Non-heated Attic Spaces, Ceiling Spaces, Porte Cochere and other spaces containing sprinkler piping that do not have alternate provisions to guarantee a 40° F temperature.	Ordinary Group 1	.14	1,950 sq. ft.	130 sq. ft.	250 gpm
Ballrooms, exterior loading docks, distilleries, barns and stables, dry cleaners, libraries, machine rooms, and auto repair shops.	Ordinary Group 2	.20	1,500 sq. ft.	130 sq. ft.	250 gpm
Dry Pipe System:	Ordinary Group 2	.19	1,950 sq. ft.	130 sq. ft.	250 gpm
Upholstery shops, sawmills, plywood manufacturers, or textile factories, Low-pilled storage, dust or lint generated areas, palletized, bin box, shelf, rack, back to back shelf storage of cartooned group A, storage of tissue and lightweight rolled paper.	Extra Hazard Group 1	.30	2,500 sq. ft.	90-130 sq. ft.	500 gpm
Plastic manufacturing operations, steel manufacturing, and automobile paint spray booths, Space with high combustible or flammable liquids, palletized, bin box, shelf, rack, back to back shelf storage of cartooned group A, storage of tissue and lightweight rolled paper	Extra Hazard Group 2	.40	2,500 sq. ft.	90-130 sq. ft.	500 gpm

H. Available fire-hydrant flow test records indicate the following conditions:
   1. <u>NOT AVAILABLE, provide break tank and fire pump as shown.</u>

I. The fire protection system design shall include a minimum of 10 psi safety factor to allow for future losses in the water service pressure characteristics. The fire protection systems shall not be designed to operate if the residual pressure of the existing water service falls to 20 psi or lower at design flow requirements.

J. The maximum allowable system velocities shall not exceed 20 fps unless alternate criteria are required by the Owner's Insurance Underwriter.

K. Coordination:
   1. The Fire Protection Contractor shall review the complete set of project documents and coordinate his work with all other trades involved.
   2. Sprinkler head locations shall be coordinated with the architectural reflected ceiling plans. Locations of sidewall heads shall be coordinated with architectural interior elevations.
   3. The fire protection piping and head layout shall function in such a manner so as not to interfere with lighting fixtures, air distribution devices, equipment, piping, and ductwork.

L. Sprinkler Systems
   1. Any design documents issued to the Contractor are for information only. The Contractor shall be responsible for the actual layouts, general routing of piping and additional sprinkler heads to meet all requirements.

M. All underground mains and appurtenances are to be installed according to NFPA 24.

N. Fire Protection System Alarms

   1. The fire protection contractor shall coordinate location and function of all flow, air pressure, supervisory switches, and other dry contacts with the fire alarm contractor.
   2. All control valves in the fire protection system shall be provided with supervisory switches wired for annunciation at the main FACP.
   3. Automatic sprinkler system connections shall be provided with flow switches adjacent to the zone control valve wired for annunciation at the main FACP.
   4. Upright automatic sprinklers will be provided in all elevator shafts and elevator machine rooms. The service to each of these spaces shall be provided with an individual control valve with a supervisory switch and a flow switch located in an adjacent room and wired for annunciation at the main Fire Alarm Control Panel (FACP).

1.4 EQUIPMENT, MATERIALS, BID BASIS

A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in the Specifications or on the Drawings as "base" products.

C. "Equal product" and "approved equal" items listed shall conform to specified base items and shall be substantially equal in size, weight, construction quality and capacities.

The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question.

D. The Contractor shall coordinate the installation of all fire protection equipment proposed for use in this project with all building trades (architectural, structural and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost.

1.5 TRANSPORTATION, DELIVERY, STORAGE AND PROTECTION

A. The Contractor shall provide and pay for all transportation, delivery, and storage required for all equipment and materials. Upon receipt of all equipment and materials, they shall be properly stored in their original shipping container to protect them from vandalism, theft, the elements, and other harm or damage. Any equipment or materials received in a damaged condition, or damaged after receipt, shall not be installed. Only new undamaged equipment in first-class operating condition shall be installed.

B. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

C. The Contractor shall closely coordinate the ordering and delivery of all mechanical equipment with other trades to assure that equipment will be delivered in time to be installed in the building without requiring special or temporary access or building modifications. Certain equipment may have to be installed prior to the erection of the building walls or roofs.

1.6 PRECONSTRUCTION CONFERENCE

A. The Contractor shall schedule a meeting including the sprinkler sub-contractor, Owner, Architect and Engineer prior to the installation of any fire protection pipe hangers.

1.7 SUBMITTALS

A. It is the responsibility of the Contractor to coordinate the design with the work of all other disciplines so as to avoid conflicts. Where necessary piping shall be offset around ducts, structural members or other obstructions, while maintaining effective coverage, drains shall be provided per NFPA requirements.

B. Review of the Drawings and hydraulic calculations by PBK is for coordination with the design concept for the project, and for assurance that they have been prepared in a timely manner. PBK is entitled to rely on the technical sufficiency and timely delivery of these documents, as well as on the computations performed by the subcontractor. PBK shall not be required to review or verify those computations or designs for compliance with applicable laws, statutes, ordinances, building codes, and rules and regulations.

C. Fire Protection shop drawings shall include all data required by NFPA Section 13. Shop drawing plans shall indicate all lights, grilles, soffits, alarms, speakers and other ceiling components, as well as hydraulic node points, to ensure coordination. The Contractor shall submit shop drawings to and secure approval of the Owner’s Underwriter, local authority and/or state authorities prior to submission to the Engineer. The Contractor shall not commence work, purchase, or provide any materials to the job site without obtaining

shop drawing approval. Shop drawings shall include copies of all hydraulic calculations providing design densities, where applicable. In addition, shop drawings submittals shall include printed catalog specifications and data sheets for all of the following as applicable:

1. Fire department valves
2. Sprinkler heads and accessories
3. Siamese Fire Department connection
4. Fire valve cabinets
5. Test header
6. Roof manifold
7. Backflow preventer
8. Cutting oil indicating compatibility with the CPVC sprinkler piping

D. A letter signed by an officer of the Contractor's company shall be included in the submittal book that states the following items meet or exceed the requirements of the specifications:

1. Pipe and fittings
2. Valves
3. Pipe supports
4. Pipe accessories
5. Pipe labels and valve tags
6. Flow switches
7. Tamper switches

E. All required submittal data other than fire protection shop drawings shall be transmitted simultaneously in hard ring binders with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review unless previously agreed to by the Engineer.

F. The Contractor shall not proceed with any work without final approved submittal data bearing all approval stamps.

G. Shop drawings and hydraulic calculations are to be sealed by a NICET III or IV sprinkler designer licensed in the state of Texas.

H. Provide a specification review that consists of a copy of related specification section with notations indicating compliance or deviation with each element of specification.

1.8 SPARE EQUIPMENT

A. The Contractor shall furnish and install a cabinet located in the fire service entry room with the quantity of each type of sprinklers and wrenches as required by NFPA 13:
1. Facilities with less than 300 sprinklers – 6 minimum
2. Facilities with 300 to 1000 sprinklers – 12 minimum
3. Facilities with over 1000 sprinklers – 24 minimum

PART 2 - PRODUCTS

2.1 GENERAL

A. All sprinkler system equipment is to be UL Listed or FM Approved.

B. Manufacturers.
1. Pipe.
   a. Wheatland Tube

b. Youngstown Tube Company
c. Bull Moose Tube
d. Paragon

2. Sprinkler and Alarm Valve.
   a. Anvil
   b. Viking
   c. Globe Fire Sprinkler Corp
   d. Tyco
   e. Reliable
3. Valve
   a. Viking
   b. Reliable
   c. Victaulic Company
4. Specialty Valve
   a. Potter-Roemer
   b. Tyco Fire

C. All piping, materials and equipment used in the installation of sprinkler and standpipe systems shall be new and listed as approved by the Underwriters' Laboratories, Inc., List of Inspected Fire Protection Equipment and Materials and the Factory Mutual Testing Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard and shall be the latest design of the manufacturer.

D. Pressure ratings of pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the designed system pressures in which they are installed.

E. The installing Contractor shall identify piping, fire department connections, valves and hydraulic design information in accordance with applicable NFPA Standards.

2.2 MATERIALS

A. All piping shall be made in the USA and be labeled according to City and /or State manufacturers. Pipe shall be protected with MIC shield coating.

B. All materials, pipe, valves and equipment furnished under this section shall be new and approved by NFPA, Underwriters Laboratories Inc. (UL), Factory Mutual (FM) and American Water Works Association (AWWA) where applicable.

C. Pipe and Fittings:
1. Piping – Schedule 40 ASTM A-53, A-795, A-135, black steel piping for branches (1 inch – 2 inches) and schedule 10 ASTM A-53, A-795, A-135 (2-1/2 inches – 8 inches) black steel for mains.
   a. Piping (piping only, excluding fittings) for dry systems shall be Schedule 40 ASTM 53 galvanized steel in all pipe sizes, screwed galvanized cast or malleable iron fittings through 2", grooved couplings for 2-1/2" and larger pipe sizes.
   b. Buried Water Service Entrance Piping.
      1) Pipe - Cement mortar lined ductile iron.
      2) Fittings – Cement mortar lined ductile iron using mechanical joints.
      3) Optionally, where building structural components permit, water service entrance may be composed of a single extended 90 degree fitting of fabricated 304 stainless steel tubing, maximum Working pressure of 175 psi with grooved-end connection on the

outlet (building) side and a cast iron pipe size coupler on the underground (inlet) side.

4) All pipe and fittings shall be encased with polyethylene film having a minimum thickness of 8 mils.

2. Fittings under 2-1/2 inches screwed cast iron, 175-pound S.W.P., 2-1/2 inches and larger, flanged, or grooved pipe and fittings to accept a bolted type clamp with gasket.
3. Grooved Couplings & Fittings: ductile iron with gasket and two bolts, 300 psi working pressure. Victaulic, Firelock fittings.
4. Flanges – cast iron, 175 pound S.W.P., with threaded inlet, or Victaulic Mod. #741.
5. Hangers to meet NFPA 13 spacing and type.

D. Control Valves: All control valves are to be electrically supervised. A pressure gauge, water flow switch and test connection with drain shall be provided downstream. The installation shall be per NFPA 13 requirements.
1. 2-1/2 inches and under – 175 psi, Milwaukee “Butterball” with built-in tamper switches.
2. Over 2-1/2 inches – UL listed and FM approved, 175 psi, butterfly valves or OS&Y with tamper switch.
3. All butterfly valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained within a NEMA Type 1, general purpose indoor rated housing. Either unauthorized removal of the switch housing (when the valve is open) or closing the valve, shall cause the switch contacts to change position. The switch shall have four conductors to accommodate connections to Style 4 or Style 6 signaling line circuit devices.

E. Check Valves:
1. Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod, and brass faced discs.
2. Check valves 2 inches and smaller shall be UL listed brass body and all brass fitted.

F. Alarm Check Valves: Shall be for vertical installation, cast iron, complete with retard chamberport to alarm, pressure gauges, main drain, electric alarm pressure switch with dual contacts suitable for either open or closed circuit.
1. Control valve, check valve, and pressure or flow switch tied to fire alarm system and sprinkler alarm bell.
   a. 2-1/2" to 3, Class 150, iron body, bronze disc, flanged or groove ends, TYCO Fire Products LP; AV-1-300, UL Listed for fire service.
   b. 4" and larger, Class 150, iron body, bronze trim, flanged ends, TYCO Fire Products LP; AV-1-300, flanged, UL Listed for fire service.

G. Switches:
1. Water Flow Switches: Shall be paddle type water flow alarm (or pressure switch of retard chamber) and with double contacts for either open or closed circuit operation for connection to building fire alarm system.
2. Tamper Switches: Shall be designed as an integral part of control valve assembly or tamper switch shall have double acting, spring loaded plunger to activate a single-pole double-throw switch for valve supervision of OS&Y type control valves.

H. Sprinkler Head Escutcheons.
1. Finish for all escutcheons shall match the finish of sprinkler heads on which they are used. Use white cover plates for white painted soffits and white

acoustical ceiling tile, black cover plates for black lay-in acoustical ceiling tile, custom color to match specialty ceilings.

I. Water Motor Gong
1. Provide a water motor gong. No Electric Bell.

2.3 STAND PIPES

A. Provide a complete stand pipe system with 2 ½" fire hose connections in compliance with Authority Having Jurisdiction Fire Marshal's requirements for the entire building with separate stand-pipes at auditorium stage and entrance to the auditorium.
1. Building system shall provide a 2 ½" fire hose connection at each landing of each egress stairwell and additional connections throughout the facility in order to provide complete fire hose coverage based on a 150 foot of hose with 50 foot of water spray. Locate fire hose connections in Fire Marshal and Architect approved locations such as stairwells and mechanical rooms and provide required signage. Contractor shall include stand pipe water flow requirements in hydraulic calculation for sizing of all fire water main piping and fire pump. Contractor shall include in submittal a plan showing location of all fire hose connections for approval by Authority Having Jurisdiction Fire Marshal prior to fabrication and rough-in. System shall also comply with NFPA 13 for hose connections for fire department use.
2. Provide a complete stand pipe system on each side of the auditorium stage.
3. Provide a complete stand pipe system on each side of the entrance to the auditorium.

2.4 AUTOMATIC SPRINKLER SYSTEM MATERIALS

A. The underground fire protection service shall be provided with thrust blocks and rods and clamps at the service entry.

B. Automatic sprinklers shall be provided as follows:
1. Public Spaces with Gypsum and Lay-in Ceilings
a. Fully concealed type sprinklers, glass element, or fusible link style, quick response sprinklers shall be provided in all areas with gypsum ceilings and lay-in tiles. Temperature rating of sprinklers shall be 155 – 165 degrees. Ceiling coverplate shall be factory painted to match the adjacent ceiling color; submit painted sample to the Architect for approval. Sprinkler to be Tyco, Reliable or Viking Horizon Mirage concealed sprinkler or approved equal.
2. Back-of-House Spaces and Unfinished Spaces with no Ceiling
a. Quick response upright pendent sprinklers shall be provided in all areas with no ceiling. Temperature rating is to be 165 degrees unless conditions require higher temperature. Finish of sprinkler to be rough brass. Sprinkler to be Tyco, Reliable or Viking Microfast Model M.
3. Kitchen Coolers and Freezers
a. Standard response semi-recessed chrome plated dry pendent sprinklers with sprinkler guards will be provided in all coolers and freezers. Barrel length shall be a minimum of 12" from the base of the tee to the top of the freezer. Sprinkler and escutcheon shall be polished chrome finish. Sprinkler shall be Tyco, Reliable or Viking Model M.
4. Exterior Overhangs and Elevator Shafts
a. Standard response chrome plated dry horizontal sidewall or upright sprinklers are to be provided. Barrel length shall be a minimum of 12". Sprinkler and escutcheon shall have UL Listed polyester or Teflon

corrosion protection at exterior overhangs and rough brass finish at elevator shafts. Sprinkler shall be Viking Model M.

C. All outdoor sprinkler heads shall be wax coated.

D. Alternate acceptable manufacturers with equivalent sprinklers are Automatic, Central, Anvil International, Gem and Reliable.

E. Sprinkler guards shall be installed on all sprinklers 7'-0" or less above floor.

F. Provide sprinklers at the highest and lowest level of all stairwells.

G. Provide sidewall sprinklers at the top end and bottom of all elevator hoistways. Sprinklers may be omitted from traction elevators on non-combustible elevator shafts and cabs which meet the requirements of ASME A.17.1 and where acceptable to the local authorities.

H. Provide sprinklers in electrical rooms and elevator machine rooms unless specifically prohibited by local authorities; the sprinkler supply to each space shall be provided with a supervised valve and flow switch. Coordinate the intermediate temperature rating of the sprinkler head in all elevator machine rooms with the electrical contractor to ensure sprinkler operation will not occur prior to activation of the heat detector and the shunt trip circuit breaker.

I. Sidewall sprinklers shall be installed in all electrical rooms, electrical closets and elevator machine rooms where adequate coverage is provided. Upright sprinklers shall be installed in these spaces when coverage limitations of the sidewall sprinklers are exceeded. Piping shall not be installed above any electrical equipment, switchboard or panelboard. Piping shall offset around surface mounted light fixtures where possible, provide a minimum of 6" clearance below the bottom of the light fixtures at all locations.

J. The property is to be fully sprinklered throughout per the requirements of NFPA unless specifically noted otherwise. Elimination of sprinklers in electrical rooms, elevator shafts and elevator machine rooms shall be clearly indicated on the shop drawing submittal noting the exception applied for the deletion of sprinklers in these spaces.

K. The Contractor shall provide and place suitable signs indicating the purpose of each control valve, test connection, main and auxiliary drain, etc., as required.

L. Provide higher intermediate temperature rated sprinklers in all areas required due to service conditions and as required by NFPA 13.

M. Provide sprinkler connections to all required food service hood suppression systems.

N. Sprinkler guards shall be installed on all sprinklers located in cafeteria and the gym.

O. Flex head type systems allowed. Maximum 3-foot braided stainless-steel type by Victaulic as per LCISD Technical Design Guidelines.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for conditions under which work is to be performed. Report in writing to the Architect all conditions that will adversely affect satisfactory execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. The Drawings are diagrammatic and the final arrangement of the work shall suit field conditions, the characteristics of the materials used and coordination with all other disciplines and the building components and finishes. Verify all dimensions in the field. Access and clearances must be provided and maintained for the proper operation, maintenance service and repair of the work.

B. No sprinklers are to be installed prior to the building being completely sealed in from external moisture and conditions.

C. All standpipe, sprinkler and drain piping exposed to sight in stairwells is to be painted with two coats of an epoxy based paint, color to be selected by the Architect.

D. All equipment and materials shall be installed according to manufacturer's recommendations and shall meet the requirements of NFPA and the Owner's Insurance Underwriter.

E. All sprinklers in spaces visible to public view shall be located symmetrically in relation to ceiling design elements, lighting fixtures, speakers, diffusers, etc. All ceiling components are to be indicated on the submittal drawings as noted previously to ensure coordination with all ceiling elements and devices. Piping to sprinklers in these areas is to be provided with arm-overs to allow for exact placement of sprinklers.

F. Sprinklers shall be installed at the centerpoint of all 2' x 2' lay-in ceiling tiles, and at the centerpoint or 1' from the ends of 4' x 2' ceiling tiles. For every sprinkler head, tap main/branch pipe serving each individual sprinkler head shall come from the top of pipe to prevent trash from collecting at head. (**Piping laterals to a sprinkler head is FORBIDDEN off the bottom of the main or lateral piping system**).

G. Where pipe is installed above suspended ceilings, it shall be located in the clear space above the suspended ceiling and the pendent sprinklers shall be located to clear the ceiling supporting grid system, the ceiling mounted fixtures, and air conditioning ducts and outlets.

H. The Contractor shall install additional pendent sprinkler heads under all ductwork or other obstructions which are over 48" wide in accordance with NFPA-13 in areas of exposed construction.

I. Dry pipe systems shall be specified as installed with the longitudinal weld seam located above the horizontal centerline of the pipe, and with drain valves installed at all low points regardless of trapped water volume. Require that mains and branch lines be pitched at least 1 /2 in. per 10 ft in all locations, including in non-refrigerated areas (areas not subject to freezing).

J. Provide a pressure gauge at the top level of all standpipes.

K. Provide tracer wire on all pipe installed below slab outside building; locate leads in accessible location for future use in trouble shooting.

L. Horizontal branch piping shall be pitched to mains per NFPA. Locate all sprinkler mains a minimum of 24" above any finished ceiling.

M. Hydraulic information placards with permanent markings indicating the hydraulic design criteria for each separate system should be installed on each riser.

N. Provide basket type metal guards over sprinkler heads to protect them from damage in mechanical rooms, main electrical and telephone equipment, gymnasium areas, storage rooms and all unfinished areas where the head is less than 7 feet-0 inches above finished floor.

O. All threads for fire department connections shall match the local Fire Department connecting threads and requirements.

P. Building shall be 100 percent fully sprinklered.

Q. Sprinkle Zones shall comply with NFPA 13, for areas limitations, provide a minimum of TWO sprinkler systems with separate alarm check valve assemblies.

R. Fire Alarm System: Coordinate with Division 26 to provide connections to all supervised devices and flow switches as well as any other items requiring connection to the fire alarm system, provide all wiring and equipment.

S. Stages: At each side of each stage provide a complete Authorities having Jurisdiction and NFPA compliant class III standpipe system with 1.5" and 2.5" fire department hose connections. Mount hose connections in Potter-Romer lockable, clear glass front cabinet. Coordinate exact location of standpipes with stage equipment.

T. Maintain a minimum 3' horizontal separation between any recessed, pendant sprinkler head and any wall, partition, furr-down, or other vertical surface.

U. If a deluge system in required, the system shall be installed so that the deluge system will not engage during a fire drill and/or in fire test mode.

3.3 CLEANING

A. The entire underground and above ground sprinkler system shall be cleaned and flushed in accordance with NFPA 13, 24, 25.

B. Capped connections shall be located at the ends of sprinkler main piping to facilitate flushing and cleaning of systems.

C. Remove all trash and debris from site and dispose of legally.

D. All equipment shall be thoroughly cleaned and left in a satisfactory condition for proper operation at project completion. All equipment shall be partially or fully re-painted as required to provide an appearance of new equipment.

3.4 TESTS

A. Tests of all fire protection systems and equipment, underground and inside piping including alarm and detection devices shall be scheduled with one (1) week prior notification to a local representative of the Underwriter and the Architect. All tests and test procedures shall be in accordance with the applicable NFPA standards. After completion of all tests, the “Contractor’s Materials and Test Certificate” shall be submitted to the Architect.

B. The Contractor shall supply all materials, labor, utilities and power required for testing. Preliminary tests shall be performed to prove work is satisfactory prior to requesting a test inspection. Sectional tests shall be made before insulation or concealing any piping.

C. Repair all defects disclosed by tests or, if required by the Architect, replace defective work with new systems and materials at no additional cost to the Owner. Repairs to piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Make tests in stages to facilitate work of others.

D. The Contractor shall be responsible for the repair and/or replacement cost installed and finishes damaged by leaks, tests and/or repair and replacement of his work at no additional expense to the Owner.

E. Prior to final acceptance by the Owner, submit the “Contractor’s Material and Test Certificates” indicating system compliance with all applicable sections of NFPA.

END OF SECTION 21 11 13

SECTION 21 30 00 – FIRE PUMP AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE PROTECTION.

C. SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION SYSTEM

D. SECTION 21 05 48.13 - VIBRATION CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

E. SECTION 21 11 13 – FIRE SUPRESSION SYSTEMS.

F. SECTION 28 31 00 - FIRE DETECTION AND NOTIFICATION SYSTEMS.

1.2 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Architect shall be notified of the discrepancy.

1.3 WORK INCLUDED

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

C. Coordinate sizes and locations of concrete bases with actual equipment provided.

D. Alarm devices including alarm valves, flow switches/pressure switches, tamper switches and coordination with Fire Alarm and Detection Contractor.

E. Shop drawings and calculations prepared and submitted in accordance with the requirement of all Authorities Having Jurisdiction.

F. All permits and approvals of the fire protection system.

1.4 SYSTEMS

A. Systems to be provided under the Fire Protection design section shall be as listed below. The connection point to the site utility service for the fire protection system shall be at 5'-0" from the exterior of the building unless specifically otherwise noted.

1. **Horizontal** fire pump.
2. Fire pump accessories and specialties.
3. Flowmeter systems.
4. Pressure Booster (Jockey) pump.
5. Electric Fire Pump Controller.
6. Fire and Domestic Water Storage Tank.

1.5 QUALIFICATION OF CONTRACTORS

A. The Contractor for the fire protection installation shall be a certified fire protection contractor, licensed for the installation of automatic fire sprinkler systems and other fire protection equipment.

B. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

1.6 GUARANTEE

A. All fire protection work described in the Contract Documents shall be guaranteed for a period of one (1) year from the date of final acceptance. This guaranty shall apply to all equipment, materials and workmanship. During the guaranty period, all defects shall be corrected in an acceptable manner, consistent with the quality of materials and workmanship of original construction, at no expense to the Owner.

1.7 DESIGN STANDARDS

A. Fire Protection systems shall be designed and installed in accordance with the requirements of the most current version of the following codes, standards and design guides:

1. The International Fire Prevention Code
2. The International Building Code
3. National Fire Protection Association (NFPA) Standards:
   a. NFPA 101 - Life Safety Code
   b. NFPA 13 - Installation of Sprinkler Systems
   c. NFPA 14 - Installation of Standpipe and Hose Systems
   d. NFPA 20 - Installation of Centrifugal Fire Pumps
   e. NFPA 24 - Installation of Private Fire Service Mains

f. NFPA 25 - Inspection, Testing, and Maintenance of Water-based Fire Protection Systems

B. Factory Mutual (FM) Approval Guide

C. Underwriters Laboratories Inc. (UL)

D. Owner's Insurance Underwriter Requirements

1.8 ORDINANCES, PERMITS AND DRAWING APPROVALS

A. The Contractor shall file all requisite plans relating to this section of the specifications with the proper authorities, secure all permits and approvals and pay all resultant fees for work done under this section.

B. All fire protection work shall comply with all laws, ordinances, rules, regulations and standards of the City, County, State and the Owner's Insurance Underwriter; all applicable sections of the National Fire Codes and the Codes and Standards of the National Fire Protection Association.

C. If code or other requirements exceed the provisions shown on the Contract Documents, the Architect shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.9 EQUIPMENT, MATERIALS, BID BASIS

A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in the Specifications or on the Drawings as "base" products.

C. "Equal product" and "approved equal" items listed shall conform to specified base items and shall be substantially equal in size, weight, construction quality and capacities. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question.

D. The Contractor shall coordinate the installation of all fire protection equipment proposed for use in this project with all building trades (architectural, structural and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost.

1.10 TRANSPORTATION, DELIVERY, STORAGE AND PROTECTION

A. The Contractor shall provide and pay for all transportation, delivery, and storage required for all equipment and materials. Upon receipt of all equipment and materials,

they shall be properly stored in their original shipping container to protect them from vandalism, theft, the elements, and other harm or damage. Any equipment or materials received in a damaged condition, or damaged after receipt, shall not be installed. Only new undamaged equipment in first-class operating condition shall be installed.

B. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

C. The Contractor shall closely coordinate the ordering and delivery of all mechanical equipment with other trades to assure that equipment will be delivered in time to be installed in the building without requiring special or temporary access or building modifications. Certain equipment may have to be installed prior to the erection of the building walls or roofs.

1.11 PRECONSTRUCTION CONFERENCE

A. The Contractor shall schedule a meeting including the sprinkler sub-contractor, Owner, Architect and Engineer prior to the installation of any fire protection pipe hangers.

1.12 SUBMITTALS

A. It is the responsibility of the Contractor to coordinate the design with the work of all other disciplines so as to avoid conflicts. Where necessary piping shall be offset around ducts, structural members or other obstructions, while maintaining effective coverage, drains shall be provided per NFPA requirements.

B. All required submittal data other than fire protection shop drawings shall be transmitted simultaneously in hard ring binders with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review unless previously agreed to by the Engineer.

C. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each fire pump, from manufacturer.

E. Source quality-control reports.

F. Field quality-control reports.

G. The Contractor shall not proceed with any work without final approved submittal data bearing all approval stamps.

H. Provide a specification review that consists of a copy of related specification section with notations indicating compliance or deviation with each element of specification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

D. All piping, materials and equipment used in the installation of sprinkler and standpipe systems shall be new and listed as approved by the Underwriters' Laboratories, Inc., List of Inspected Fire Protection Equipment and Materials and the Factory Mutual Testing Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard and shall be the latest design of the manufacturer.

E. Pressure ratings of pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the designed system pressures in which they are installed.

F. The installing Contractor shall identify piping, fire department connections, valves and hydraulic design information in accordance with applicable NFPA Standards.

2.2 FIRE PUMP

A. Electric motor driven fire pump with jockey pump and electric controllers.

B. The fire pumps shall be designed to deliver the capacity necessary to comply with NFPA 13 and NFPA 20 and to provide a complete, code compliant pumped fire protection system. Fire pumps shall furnish not less than 150 percent of rated capacity at not less than 65 percent of total rated head. The shutoff head shall not exceed 120 percent of total rated head.

C. Manufacturers:

1. Armstrong
2. Aurora
3. Peerless
4. Fairbanks-Morse
5. Patterson Fire Pump

D. Horizontal Base Mounted Pumps:
1. Type: UL 448 horizontal shaft, single stage, double suction, direct connected, horizontally split casing for 250 psig maximum working pressure.
2. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections.
3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
4. Bearings: Grease lubricated ball bearings, replaceable without opening casing.
5. Shaft and sleeve: Alloy steel with replaceable bronze shaft sleeve.
    a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
    b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
    c. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.

6. Drive: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
7. Baseplate: Cast iron with integral drain rim.

E. Electric Motor Drive
1. Motor: Standard UL 1004A, squirrel cage induction type; in open drip proof NEMA MG-1 enclosure, 1750 rpm.
2. Electrical Characteristics:
   a. Volts: **460**
   b. Phase: Three.
   c. Hertz: 60

2.3 FIRE PUMP ACCESSORIES AND SPECIALTIES

A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

C. Relief Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   a. BERMAD Control Valves.
   b. CLA-VAL Automatic Control Valves.
   c. OCV Control Valves.
   d. Watts Regulator Company; a division of Watts Water Technologies, Inc.
2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

F. Hose Valve Manifold Assembly:
1. Standard: Comply with requirements in NFPA 20 and NFPA 25.
2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
4. Automatic Drain Valve: UL 1726.
5. Manifold:
   a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
   b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
   c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
   d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
   e. Escutcheon Plate: Brass or bronze; rectangular.
   f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
   g. Exposed Parts Finish: **Polished chrome plated**.
   h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST.

6. Manifold:
   a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
   b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
   c. Escutcheon Plate: Brass or bronze; round.
   d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
   e. Exposed Parts Finish: Polished chrome plated.
   f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

2.4 FLOWMETER SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
   1. Emerson Process Management; Rosemount Division.
   2. Fire Research Corp.
   3. Gerand Engineering Co.
   4. Hydro Flow Products, Inc.
   5. Hyspan Precision Products, Inc.
   6. Meriam Process Technologies.
   7. Preso Meters; Division of Racine Federated Inc.
   8. Reddy-Buffaloes Pump Company.
   9. Victaulic Company.

B. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.

C. Pressure Rating: [**175 psig (1200 kPa) minimum**] [**250 psig (1725 kPa)**].

D. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.

E. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting.
   1. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) **soft copper** tubing with copper or brass fittings and valves.

F. Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case.

2.5 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 PRESSURE BOOSTER (JOCKEY) PUMP

A. Electrically operated, horizontal close-coupled type with standard open drip-proof horizontal motor.

B. Each pump shall be multistage bronze fitted turbine type with bronze impeller, stainless steel shaft, and grease-lubricated ball bearings, similar and approved equal to Aurora Series 11 0.

C. The fire system jockey pump shall be furnished with a factory-mounted bypass relief valve complete with piping. Set relief pressure above the design total dynamic head as required to prevent motor overload and damage to the system.

D. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

E. The jockey pump control panel enclosure shall be NEMA 3R wall-mounted, factory assembled, wired, and tested and shall be finished with a baked enamel coating. Panel shall include at least the following equipment:
   1. One non-fused disconnect switch mounted on panel door.
   2. One combination magnetic motor controller.
   3. One hand-off-automatic selector switch mounted on panel door.
   4. 120 volt control power transformer and fused disconnect switch as required to operate switches and controls in the panel.

F. The jockey pump controller shall be manufactured by Metron, Firetrol, Sylvania/Clark or Master.

2.7 ELECTRIC FIRE PUMP CONTROLLER

A. The electric fire pump controller shall be manufactured by Metron, Firetrol, Sylvania/Clark or Master.

B. The fire pump controller shall be UL/FM approved for automatic and manual start and UL Labeled for service entrance. Controller shall have a NEMA 2 enclosure, 100,000 AIC circuit breaker, disconnect, wye-delta closed transition starter, automatic transfer switch, pressure control, minimum run timer, pilot light, start-stop push buttons, manual operator, alarm relays, sequence start timer, phase reversal monitor, alarm bell and lights, fused power control transformer, and remote annunciator all as required by and in accordance with NFPA 20 and Electric Code, NFPA 70 and include the following:
   1. The locked rotor overcurrent protection shall be provided by a separate overcurrent monitor of the microprocessor type, set at 300 percent of motor full load current and shall have a trip time between 8 and 20 seconds at 600 percent of motor full load current.
   2. Isolation switch with single external operating handle interlocked with circuit breaker. Operating mechanism shall be flange or side mounted.
   3. Nonfused control power transformer.
   4. START and STOP pushbuttons for manual control.
   5. Ammeter test links and voltmeter test studs.
   6. POWER AVAILABLE pilot light to indicate power on the load side of the circuit breaker and PHASE REVERSAL pilot light for the line side of the motor starter. Pilot lights shall be mounted externally.
   7. Surge protector wired to the line side of the isolation system.

8. Solid state pressure switch and transducer with energize to start relay. Pressure switch shall be differential adjustable type with LED indicators for trip and reset. NOTE: Pressure switches in systems exceeding 175 psi shall have a range from 0 to 600 psi.
9. Minimum run time, adjustable 0 - 10 minutes with timed-out LED indicator. Per NFPA 20 and FM pump should be arranged for “manual stop” the run-timer and auto stop function must be disabled.
10. Magnetic contactors with externally operable mechanical start mechanism.
11. Two sets each of dry form "C" contacts for remote indication of PUMP RUNNING, POWER FAILURE and PHASE REVERSAL.
12. The electric fire pump controller shall also include an automatic start relay of the drop-out type, and a local built-in alarm panel powered from a separate reliable 120 VAC power source.
13. The local alarm panel shall have individual indicating lights with a common alarm bell and silence button for POWER FAILURE, PUMP RUNNING, PHASE REVERSAL, LOW DISCHARGE PRESSURE, TRANSFER SWITCH IN EMERGENCY, ISOLATION SWITCH OPEN and REMOTE START.
14. A local indicating light and two sets of remote alarm contacts shall be furnished to monitor SUPERVISORY POWER of the local alarm panel.
15. Two sets of dry form "C" remote alarm contacts shall be provided for LOW DISCHARGE PRESSURE, TRANSFER SWITCH IN EMERGENCY and ISOLATION SWITCH OPEN.
16. A separate pressure switch shall be supplied to monitor discharge pressure.
17. All indicators shall be illuminated from the rear by long life LED lamps. Incandescent lamps are not acceptable

C. ***The fire pump controller shall be factory assembled, wired and tested with an Automatic Transfer Switch (ATS) listed by Underwriters' Laboratories, Inc. for transfer switch and fire pump controller service, and shall conform with NFPA 20 and NFPA 70 and be in accordance with UL 1008 and UL 508. Ammeter test links and voltmeter test studs shall be provided in the enclosure and a two-position pushbutton marked "START-STOP" and an emergency start handle shall be provided on the enclosure.***

D. ***The automatic transfer switch shall be wired to the fire pump controller and mounted in a separate compartment with an isolation barrier. The automatic transfer switch shall include an isolation switch and externally operable handle, voltage and frequency sensitive relays for normal power, voltage and frequency sensitive relays for emergency power sensed from emergency control power transformer, normal and emergency control power transformers, and time delays for ENGINE START, TRANSFER TO EMERGENCY, RETRANSFER TO NORMAL and ENGINE COOLDOWN. The transfer switch shall also include provisions for preventing higher than inrush currents when transferring power in either direction, a TEST switch and pilot lights for NORMAL POWER and EMERGENCY POWER***.

E. A remote annunciator panel shall be furnished and installed by this Division in the Fire Command Center and shall be wired to the fire pump controller by Division 26. The remote annunciator shall be flush mounted and shall have an audible alarm with silence pushbutton and indicator lights for "Fire Pump Running", "Loss of Main Power", "Phase Reversal", **["Emergency Isolation Switch Off"]** and "Low Discharge Pressure". **[The remote alarms shall also have alarm output contacts for monitoring of fire pump trouble and run alarms by the Fire Alarm System specified under Division 28**] **[and the Building Control and Automation System specified [in Section 23 06 00, "Building Controls",] [under Division 23]].**

F. **All fire pump controller [ATS] and remote annunciator control switches and indicators shall have engraved identifying nameplates.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for conditions under which work is to be performed. Report in writing to the Architect all conditions that will adversely affect satisfactory execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 MANUFACTUERER'S INSTRUCTIONS

A. Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 INSTALLATION

A. The Drawings are diagrammatic and the final arrangement of the work shall suit field conditions, the characteristics of the materials used and coordination with all other disciplines and the building components and finishes. Verify all dimensions in the field. Access and clearances must be provided and maintained for the proper operation, maintenance service and repair of the work.

B. Install in accordance with ULC listing, ANSI/NFPA 20, manufacturer's instructions and approved shop drawings.

C. Install engine cooling system.

D. Insulate exhaust system, cooling system muffler in accordance with Section 21 05 00 - Thermal Insulation for Piping.

E. Align pump and motor shafts to within manufacturer's recommended clearances prior to start-up.

F. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

G. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings or pump suction and discharge.

H. Flow meter shall discharge into atmospheric suction tank. Flow meter loop shall not circulate back to the pump suction line.

I. Locate fire pump test hose valve header on exterior wall accessible from grade level.

J. Provide piping to, and route discharge from all relief valves and drains to exterior of building and terminate at a location and in a manner to prevent any damage to surrounding areas.

K. Provide full line size bypass with double-check valve assembly around surge tank and fire pump.

L. Coordinate connection to electrical service.

M. Provide a pressure gauge at supply and suction side of fire pump.

3.4 DEMONSTRATION

A. To obtain complete and final acceptance of the fire protection system, all inspections, approvals, examination and acceptance tests required by the Authority Having Jurisdiction shall be arranged and paid for under this Section.

B. Sprinkler Contractor shall provide necessary equipment and test materials for testing of the installation.

C. Testing of the completed sprinkler system for acceptance shall be witnessed by an Owner's representative. Testing should be coordinated with the Authority Having Jurisdiction.

D. Provide the Owner with as-built drawings and equipment data at completion of construction.

E. Provide completed Underground and Aboveground Contractor's material and Test Certificates per NFPA 20 at time of acceptance of test.

3.5 WORKMANSHIP

A. All work shall be coordinated with the work to be performed or installed under other sections of these Specifications.

B. All work shall be executed in a workmanlike manner by workmen skilled in this type of work and shall present a neat appearance when completed.

C. Offsets shall be provided as required to avoid interference and conflicts with other work, to maximize headroom, or to improve the appearance of pipe runs. All pipe supports, structural members, hangers and other apparatus necessary to support firmly and substantially the various components of the systems shall be provided under this section.

D. Nameplates, catalog numbers and rating identifications shall be securely attached to equipment with screws or rivets. Adhesives or cements will not be permitted.

E. The subcontractor shall be responsible for the protection of the work from injury and shall protect all apparatus with suitable enclosures.

3.6 INSTRUCTIONS AND START-UP

A. Contractor shall provide for the service of a competent factory-trained supervising agent from the fire pump manufacturer to inspect the completed installation, start the system and acquaint the operators with the proper operation and maintenance of the equipment.

3.7 TESTS

A. Tests of all fire protection systems and equipment, shall be scheduled with one (1) week prior notification to a local representative of the Underwriter and the Architect. All tests and test procedures shall be in accordance with the applicable NFPA standards. After completion of all tests, the “Contractor’s Materials and Test Certificate” shall be submitted to the Architect.

B. The Contractor shall supply all materials, labor, utilities and power required for testing. Preliminary tests shall be performed to prove work is satisfactory prior to requesting a test inspection. Sectional tests shall be made before insulation or concealing any piping.

C. Repair all defects disclosed by tests or, if required by the Architect, replace defective work with new systems and materials at no additional cost to the Owner. Repairs to piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Make tests in stages to facilitate work of others.

D. The Contractor shall be responsible for the repair and/or replacement cost installed and finishes damaged by leaks, tests and/or repair and replacement of his work at no additional expense to the Owner.

E. Prior to final acceptance by the Owner, submit the “Contractor’s Material and Test Certificates” indicating system compliance with all applicable sections of NFPA.

3.8 INSTRUCTION OF OWNER’S PERSONNEL

A. See related section 21 05 00.

3.9 OPERATION AND MAINTENANCE MANUALS

A. See related section 21 05 00

END OF SECTION 21 30 00

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide all work for plumbing and fire protection systems required in the project to be properly installed, tested, and performing their intended function.

B. All materials and equipment for the potable water system shall meet the latest amendments, mandates, and requirements for lead free required by law that went into effect January 2014.

C. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc., required and/or necessary to completely install, clean, inspect, adjust, test, balance, and leave in safe and proper operating condition for all systems. All work shall be accomplished by workmen skilled in the various trades involved.

D. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawings and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.

E. Unless directly specified otherwise, all noted pipe diameters herein are nominal.

1.3 QUALITY ASSURANCE

A. Perform all work in accordance with the latest edition of the applicable codes, Specifications, local ordinances, industry standards, utility company regulations, and nationally accepted codes.

B. All materials, distribution, and utilization equipment shall be UL Listed.

C. All equipment and materials shall be new, unused, of United States domestic manufacture, and comply with the Buy America Act, unless approved otherwise by the Engineer or Owner.

D. Eliminate any abnormal sources of noise that are considered by the Architect or Engineer to not be an inherent part of the systems as designed without additional cost to the Owner.

E. An approved Contractor for the work under this Division shall be:

1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system.

2. Able to furnish evidence of having contracted for and installed not less than (3) systems of comparable size and type that have served their Owners satisfactorily for not less than (3) years.

1.4 WORK INCLUDED

A. Systems: Plumbing systems installed, and the work performed under this Division of the Specifications, shall include, but are not necessarily limited to, the following systems as noted below. The connection point for all systems from the site utilities shall be at 5'-0" from the exterior of the building unless specifically noted otherwise.

1. Domestic cold water, hot water, hot water recirculation systems
2. Domestic water softening system
3. Grease waste and waste systems from food service areas
4. Natural gas systems
5. Primary storm drainage, secondary storm drainage systems
6. Sanitary drainage, waste, vent systems

B. Contract quality control including workmanship, manufacturer's instructions, mock-ups, and demonstrations.

1. Executing Mock-ups:
   a. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals, and finishes.
   b. Do not proceed with any work involving a mock-up until the related mock-up has been approved in writing.
   c. Acceptable mock-ups in place shall be retained in the completed work.
   d. Perform tests and submit results as specified.
2. Scheduling Mock-ups: Schedule demonstration and observation of mock-ups, in phases, with Architect/Engineer for:
   a. Rough-in
   b. Finish with all appurtenances in place
   c. Insulation installed
   d. Demonstrations

1.5 COMPLETE PERFORMANCE OF WORK

A. All labor, materials, apparatus, and appliances essential to the complete and proper functioning of the systems described and/or indicated herein, or which may be reasonably implied as essential, whether mentioned in the Contract Drawings and Specifications or not, shall be provided by the Contractor. The entire installation shall be ready in every respect for the satisfactory and efficient operation when completed.

B. Provide all rigging required for complete installation and furnish Drawings showing necessary points of support, reactions, and supplementary bracing. This shall be submitted for approval by the Owner. Should any shoring be required, provide same after Owner's approval.

C. Become thoroughly acquainted with the work involved; obtain and verify at the building all measurements necessary for the proper installation of work. Furnish to other Contractors any information relating to work of this Division necessary for the proper installation of

their Contracts. Confer with other Contractors for finish adjacent to work of this Section and arrange to have visible portions of the work (e.g., access doors, grilles, escutcheons, etc.) fit in and harmonize with the finish in a manner satisfactory to the Architect.

D. Transmit to trades doing work of other Sections all information required for work to be provided under their respective Sections (e.g., freshwater connections, foundations, electric wiring, access doors, etc.) in ample time for installation.

E. Where disagreements occur between the Plans and the Specifications, or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in the Base Bid.

1.6 COORDINATION WITH OTHER TRADES

A. Coordinate the work of this Division with all other Divisions to ensure that all components of plumbing and fire protection systems will be installed at the proper time and fit the available space.

B. Locate and size all openings in work of other trades required for the proper installation of the plumbing and fire protection systems' components.

C. Make all plumbing and fire protection connections to all equipment furnished by this Division and as required by any other Division.

D. Electrical wiring, control equipment, and motor starters indicated on the electrical Drawings, except items otherwise specifically noted, shall be furnished and installed by the electrical trades. Items of electrical control equipment specifically mentioned to be furnished by the plumbing trades, either in these Specifications or on the plumbing Drawings, shall be furnished, mounted, and wired by this trade unless where otherwise specified in Division 26 or noted on the electrical Drawings to be by the electrical trades. All wiring shall be in accordance with all requirements of the electrical Sections of these Specifications.

E. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment. All controllers furnished with plumbing equipment shall have overload protection in all phases. It shall be the responsibility of each Subcontractor furnishing motors and devices to advise electrical Contractor of exact function of systems to assure proper type of starter with correct number of auxiliary contacts for proper operation of the system.

F. The plumbing trades shall coordinate with the electrical to ensure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner because of lack of such coordination.

G. The design of the electrical system(s) is based on the plumbing equipment specified and scheduled on the Drawings. Where changes or substitutions are made that involve additional electrical work (larger-size motors, larger number of motors, additional wiring of equipment, etc.), the plumbing trades shall pay the electrical trades for the cost of the additional work, except for changes by bulletin.

H. Motor control equipment which is furnished loose under Division 23 shall be delivered to the electrical Contractor at the site for custody, erection in place, and wiring as specified.

I. Smoke detection systems shall be furnished and installed under Division 26. Coordinate locations with electrical Contractor.

1.7 DRAWINGS

A. The Drawings are schematic in nature but shows the various components of the system(s) approximately to scale and attempts to indicate how they are to be integrated with other parts of the building. Contractor shall determine exact locations by review of equipment manufacturer's data, jobsite measurements, checking the requirements of other trades, and reviewing all Contract Documents. The size of the plumbing and fire protection equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed and approved manufacturers shall be acceptable, it is the responsibility of the Contractor to determine if the equipment that the Contractor proposes to furnish will fit in the space. The Drawings are not intended to show exact locations of pipes and ducts, nor to indicate all offsets, fittings, and supports, but rather to indicate approximate layout.

B. The mechanical, electrical, plumbing, and fire protection Drawings are necessarily diagrammatic in nature and cannot show every connection in detail in its exact location. These details are subject to the requirements of ordinances, structural conditions, and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases, suspended ceilings, soffits, finished portions of the building, etc., unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. When the mechanical, electrical, plumbing, and fire protection Drawings do not give exact details as to the elevation of pipe, conduit, and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system(s) involved. Exposed piping and ductwork are generally intended to be installed true and square to the building construction and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

D. The locations, arrangement, and extent of equipment, devices, and other appurtenances related to the installation of the work shown on the Drawings are approximate. The Contractor shall not scale Drawings; rather, the Contractor shall refer to the Architect Drawings for exact dimensions of building components. Should a conflict exist between the Architect and Engineer Drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy for resolution.

E. Materials, equipment, or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. The Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.8 SUBSTITUTIONS

A. The products described in the Proposal Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. The materials and equipment named in these Specifications and the procedures covered by these Specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. Refer to Division 01 Specification for additional requirements.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least **seven (7)** days prior to the date for receipt of proposals. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cutsheets, performance and test data, and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

C. The Architect and Owner reserve the right to disapprove the use of any manufacturer who, in their judgement, is unsuitable for use on the Project and that decision shall be final.

D. **No substitutions will be considered after the Award of Contract.**

E. Requests for Substitutions: Submit three (3) copies of each request for substitution. In each request, identify the product, fabrication method, or installation method to be replaced by the substitution; include related Specifications Section(s), Drawing(s), and complete documentation showing compliance with the requirements for substitutions. Include, as appropriate with each request, the following information:

1. Product data, drawings, and descriptions of products, fabrication methods, and installation procedures.

2. Samples where applicable or requested.

3. A detailed comparison of the significant qualities of the proposed substitution with those of the work originally specified. Significant qualities may include elements such as size, weight, durability, performance, and visual effect where applicable.

4. Coordination information, including a list of changes or modifications needed by other parts of the work and construction, to be performed by the Owner and separator Contractors that will become necessary to accommodate the proposed substitution.

5. A statement indicating the effect the substitution will have on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

6. Cost information, including a proposal of the net change, if any, in the Contract Sum.

7. Certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation, the proposed substitution will result in work that in every significant respect is equal to or better than the work required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

8. A statement indicating the Contractor will reimburse the Owner and pay for all costs, including the Architect and Engineer's redesign and evaluation costs, resulting from the use of the proposed substitution.

9. Conditions: The Contractor's request for substitution will be received and considered when extensive revisions to the Contract Documents are not

required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request is timely, fully documented, properly submitted, and when one (1) or more of the above conditions are satisfied, then the substitution will be judged and determined by the Architect and Engineer; otherwise, the requests will be returned without action except to record non-compliance with these conditions and requirements.

1.9 SUBMITTALS

A. Provide shop drawings and complete product data as indicated in each Specifications Section.

B. Coordination drawings: Using the mechanical ductwork shop drawings as a basis, provide a composite set of AutoCAD drawings in which the ductwork and piping as well as the major mechanical, plumbing, and fire protection equipment are superimposed on the architectural reflected ceiling plan and structural framing plan. Include spot elevations of bottom of steel along with finished ceiling height. Prepare at one-eighth (0.125) inch scale or larger and drawing per building area. Provide one-quarter (0.25) inch scale enlargements of locations where special attention to rough-in dimensions as required to ensure all systems will fit within the available space.

C. Shop drawings will be reviewed and returned to the Contractor with one of the following categories:

1. **Reviewed:** No further submittal action is required. Submittal shall be included in the Operation and Maintenance (O & M) manual.

2. **Revise and Resubmit:** Contractor to resubmit submittal as indicated in the comments section of the Engineer's Submittal Cover Letter.

3. **Rejected:** Contractor to resubmit new submittal when alternate or substitution is not approved and shall be required to furnish product(s) named in the Specifications and/or Drawings.

4. **Furnish as Corrected:** Contractor to submit letter verifying that the required correction(s) noted on the Engineer's Submittal Cover Letter have been received and complied with by the manufacturer(s). If equipment onsite is not in compliance with the correction(s) noted, then the Contractor shall be responsible for the cost of removing and replacing the equipment.

D. Materials and equipment which are purchased or installed without submittal review and approval will be removed and replaced with specified equipment at the Contractor's expense.

E. Provide a specification review that consists of a copy of the related specification section with notations indicating compliance or deviation with each element of the specification section.

F. All approvals required by any code or enforcement authority, insurance underwriter, etc., shall be obtained prior to equipment being submitted to the Engineer.

G. Review of the submittals by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as roof openings, wall openings, electrical characteristics, etc.

H. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to which item.

I. Submittals shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc., of the proposed equipment. Any proposed deviations from specified equipment shall be clearly indicated on the submittal.

1.10 CLOSEOUT SUBMITTALS

A. Submit in accordance with Division 01 – General Requirements and each Specification Section.

1.11 INTERFERENCE DRAWINGS

A. Where field conditions prohibit the installation of the plumbing or fire protection system components within the available space as indicated on the Drawings, the Contractor shall prepare a sketch to the minimum one-eighth (0.125) inch scale clearly depicting the conflict along with an alternate installation arrangement that satisfies the design intent of the Contract Documents without incurring additional cost.

B. Obtain written approval of proposed interference resolution prior to proceeding with alternate installation.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Accept materials onsite in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage by storing in original packaging.

C. Do not deliver items to jobsite before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.13 GENERAL ELECTRIC REQUIREMENTS

A. Provide electric motors, control panels, certain control and safety devices, and control wiring when specified or required for proper operation of electrical systems associated with plumbing equipment specified in Division 22.

B. Electrical materials and work provided shall be in accordance with Division 26.

C. The Contractor shall notify the Architect/Engineer fourteen (14) days in advance in writing before bids are due if it is necessary to adjust the horsepower of any motors or modify any electrical requirements listed or shown. After this period, costs incurred because of changes shall be assumed by the responsible Contractor.

1.14 ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

A. Plumbing equipment with factory assembled and/or attached electric equipment shall be Underwriters' Laboratories (UL) listed as an assembly when such listing is available from UL and shall meet the latest edition of the National Electrical Code.

B. Unless otherwise specified, the electrical supply being furnished is a 480 volt, 3 phase, 3 wire, 60 hertz source. A neutral connection will not be provided, the manufacturer shall

include any transformers for equipment requiring other voltages (277 volt, 120 volt, 24 volt, etc.).

C. During the submittal process, any proposed deviations from the specified equipment in the Contract Documents shall be clearly indicated on the Plumbing submittal(s). Voltages shall match that of the specified equipment in the Contract Documents; however, if the submitted equipment ampacity, horsepower, etc., differs from the specified equipment, then the Contractor shall coordinate any changes required for the submitted equipment's electrical characteristics with the Electrical Contractor at no additional cost to the Owner.

D. Electric Motors:

1. For each piece of equipment requiring electric drive, provide a motor having the starting and running characteristics consistent with the torque and speed requirements of the driven machine.

2. Manufacturers furnishing motors shall verify motor horsepower with the characteristic power curves of the driven equipment on the Shop Drawings.

3. Contractor shall verify electrical characteristics of each motor with the Electrical Drawings.

4. Motors which are shipped loose from equipment shall be set by the supplying Subcontractor.

5. Alignment of motors factory-coupled to equipment and motors field-coupled to equipment shall be rechecked by the millwright after all connections (belt drives, gear drives, impellers, piping, etc.) have been completed and rechecked again after forty-eight (48) hours of operation in designed service.

6. Where possible, motors shall be factory mounted.

1.15 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes indicating actual, final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of one-eighth (0.125) inch scale.

B. The original set of as-built drawings shall be scanned and transmitted to the Architect/Engineer in both full size bond (print) and Portable Document Format (PDF).

C. As-Built drawings: Two (2) sets are for the Owner's use and one (1) set is for the Architect/Engineer's records. Delivery of these as-built prints and reproducibility is a condition of final acceptance. Provide as-built drawings of one (1) set each of PDF and AutoCAD 2015 files on a compact disc (CD).

1. Number of Copies: Submit one (1) set of marked-up as-built prints.

2. Number of Copies: Submit copies of as-built drawings.

a. Initial Submittal:

1) Submit PDF of scanned as-built prints and one (1) set of the prints itself.

2) Submit as-built AutoCAD digital files and one (1) set of the files plotted in PDF.

3) Architect will indicate whether general scope of changes, additional information record, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF of scanned as-built prints and three (3) sets of prints itself.

2) Submit as-built AutoCAD digital files and three (3) sets of the files plotted in PDF.

3) Plot each drawing file whether changes and additional information were recorded.

D. As-built drawings should indicate the following information at a minimum:

1. Indicate all addendum changes to the Contract Documents.
2. Remove Engineer's seal, name, address, and logo from the drawings.
3. Mark and indicate these are "AS-BUILT DRAWINGS" on the documents.
4. Mark and indicate "DOCUMENT PRODUCED BY" followed with the responsible Contractor's relevant information.
5. Indicate all changes to construction during the construction process.
6. Indicate actual routing of all piping, ductwork, etc., that deviated from the Contract Documents.
7. Indicate exact locations of all below grade plumbing piping and their respective flow line elevations.
8. Correct equipment schedules to reflect actual equipment furnished and their respective manufacturer, make, and model.
9. During the execution of work, maintain a complete set of drawings and specifications where all locations of equipment, ductwork, piping, devices, and all deviations and changes from the Contract Documents in the work shall be recorded.
10. Location and size of all plumbing piping above ceiling—including exact locations of valves.
11. Indicate exact locations of all fire protection sprinkler heads and zone valves in the system.
12. Indicate exact locations of all roof-mounted equipment, wall, roof, and floor penetrations.
13. Indicate all changes with clouding around said changes.

1.16 STARTUP SERVICE

A. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and startup of all major equipment and systems including booster pumps, water heaters, sewage ejectors, lift stations, fuel oil systems, etc. A formal report shall be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the Owner's personnel shall be provided following certification of the assembly.

1.17 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades and shall furnish all information necessary to permit the work of all other trades to be installed satisfactorily and with the least possible interference or delay.

B. Piping, fixtures, and plumbing equipment shall not be installed without first coordinating the installation of it with other trades. The Contractor, at their own expense, shall relocate all piping, fixtures, and plumbing equipment installed without coordination should the plumbing elements interfere with the proper installation and mounting of electrical elements, mechanical elements, technology elements, ceilings, architectural elements, and structural elements.

C. The Contractor shall coordinate the elevations of all piping and equipment above ceilings and in exposed areas with the work of all other trades and disciplines prior to installation.

D. In areas where more than one trade is required to utilize common openings in structural beams, joists, chases, shafts, and sleeves for the passage of conduits, raceways, piping, ductwork, and other materials, the Contractor shall coordinate the positions of all piping and plumbing equipment to be furnished under this Division so that all items, including the materials and equipment of other trades and disciplines, may be accommodated within the space available.

E. The Contractor shall confirm that work installed under this Division does not interfere with the clearances required for finished columns, pilasters, partitions, walls, or other architectural and structural elements as shown on the Contract Documents.

F. Work that is installed under this contract and interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract Documents.

G. The Contractor shall examine the entire set of Contract Documents and carefully investigate the structural and architectural finish conditions affecting all their work and shall arrange such work accordingly for the complete and satisfactory operation of all systems. The Contractor shall provide all offsets, fittings, valves, devices, and accessories that may be required to meet such conditions.

1.18 WARRANTY

A. All equipment furnished and installed under this Division shall be provided with the manufacturer's standard warranty unless otherwise noted.

B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. To "make good all defects" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All equipment, materials, accessories, etc. necessary for the work required shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the manufacturer-intended use and shall be subject to approval by the Engineer.

B. All equipment, products, and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection label of Underwriters Laboratories.

D. All equipment, products, and materials for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

E. Cast iron waste piping and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute.

2.2 ACCESS PANELS

A. Acceptable manufacturers:

1. Precision Plumbing Products
2. MIFAB
3. Acudor
4. Elmdor
5. Milcor

B. Group valves together above suspending ceilings, walls, furred spaces, etc. to minimize the number of access panels required, but with all valves freely accessible for easy maintenance and inspection. Locate all valves within 1’-0” of the access panel entry point. Minimum size requirements shall be:

1. 18” X 18” for electrical-related items
2. 24” X 24” for plumbing-related items
3. 36” X 36” for mechanical-related items

C. Furnish access panels of proper size to service concealed valves, cleanouts, etc. as required. Panels shall be of the proper type for the material in which they occur and are to be furnished by the Contractor but installed by the trade for the material in which the access panel is installed.

D. Panels shall have flush doors with sixteen (16) gauge steel door; sixteen (16) gauge frame; metal wings for keying into construction; concealed hinges; screwdriver-operated stainless steel cam lock; shop-coated with one (1) coat of zinc chromate primer.

E. Access panels shall not be installed in gypsum ceilings in public spaces.

F. Valves above removable ceilings shall have tile clips by the Contractor for identification.

2.3 INSULATION

A. The following system(s) shall be insulated:

1. All domestic cold water piping above grade except at horizontal chase branch piping to individual plumbing fixtures.

2. All domestic hot water and hot water return piping except at horizontal chase branch piping to individual plumbing fixtures.

3. All horizontal storm drainage (primary) and overflow drainage (secondary) piping as well as roof drain bodies.

4. All domestic water piping exposed to areas subject to freezing. Refer to Section 22 05 00, Subsection 2.4 “HEAT CABLE FOR FREEZE PROTECTION OF PIPING” for additional requirements and information.

B. Domestic water, storm drainage, and waste drainage piping shall be insulated with four (4) lbs. density sectional fiberglass insulation. Insulation thermal conductivity k-value shall not exceed 0.24 and insulation shall have white “all service jacket” with vapor barrier. All joints and seams shall be sealed vapor tight. All seams and staples shall then be covered with “all service jacket” three (3) inch wide tape. Insulation shall be used for exposed piping.

C. Acceptable manufacturers:

1. Johns Manville “Micro-Lok AP-T”

2. Knauf “ASJ/SSL”

3. Owens Corning “ASJ/SSL”

D. Minimum requirements for piping system insulation and insulation thickness shall be as shown in the table below:

MINIMUM PIPE INSULATION			**PIPE SIZE INSULATION THICKNESS (Ø)**				
SYSTEM	**FLUID TEMP RANGE**		**≤ 1”**	**1-1/4” – 2”**	**2-1/2” – 4”**	**5” and 6”**	**≥ 8”**
	˚C	*˚F*	*inch*	*inch*	*inch*	*inch*	*inch*
Domestic cold water	ambient	ambient	0.5	1.0	1.0	1.0	-
Domestic hot water and hot water return	43.0 – 71.0	110.0 – 160.0	1.0	1.5	1.5	1.5	-
Sanitary waste above grade receiving condensate or ice machine discharge	4.5 – 15.5	40.0 – 60.0	0.5	1.0	1.0	1.5	-
Primary and secondary storm drainage	ambient	ambient	-	-	1.0	1.0	1.0

E. Insulate all horizontal storm drainage piping and horizontal overflow drainage piping with fiberglass insulation and with “all service jacket” protection. For exposed locations, provide one (1) inch thick rigid insulation with rigid jacket. Insulate from roof drain body, past first elbow fitting and including all wye fittings, all the way to the change in direction at the vertical drop to below grade.

F. Insulate all horizontal storm drainage piping and horizontal overflow drainage piping, including the roof drain bodies, with blanket-type glass fiber bonded thermosetting resin, white vinyl vapor retarding surface, and two (2) inch wide stapling/taping tab. Insulation shall be used in concealed spaces.

G. Insulate all horizontal sanitary waste piping receiving air-conditioning condensate or ice machine discharge with minimum one (1) to one and one-half (1.5) inch fiberglass insulation with jacket. Begin from the floor drain, including the p-trap, and insulate all the way to the change in direction at the vertical drop to below grade.

H. At natatoriums, including the pool equipment rooms, insulate all exposed plumbing piping with a complete aluminum jacketing system. Provide color-coded, printed pipe identification label ten (10) feet on center indicating pipe system type (e.g., storm drainage, domestic water, gas, etc.).

I. Aluminum jacketing:

1. Jacket for piping shall be 0.016 inches thick, type 3105 aluminum with factory-applied one (1) mil polykraft moisture barrier.

2. Covers for fittings shall be 0.024 inches thick, type 1100 aluminum to match pipe covering.

3. Aluminum jacketing shall be provided for all exposed piping.

4. Acceptable manufacturers:

a. ITW Insulation Systems Pabco/Childers

b. RPR Products

2.4 HEAT CABLE FOR FREEZE PROTECTION OF PIPING

A. Provide electric heat cabling on all domestic water piping and sanitary traps exposed to areas subject to freezing.

B. Acceptable manufacturers:

1. Raychem

C. Provide Raychem XL-Trace or an approved, accepted manufacturer. Heat cable shall operate at five (5) watts per foot, 120VAC, and without the use of transformers. Provide the quantity of 120VAC branch circuits required to serve the entirety of the heat cable load at a maximum of 1800 watts per circuit.

D. Installation shall consist of a complete system of Raychem RayClic connection kits, or an equal, accepted manufacturer, with a complete circuit that provides the required power connections, end seals, and controllers to ensure proper freeze protection. Splices, tees, and connection kits are used as required. Installation shall be as recommended by the manufacturer.

E. Heat cable circuit shall be protected by a ground fault device for equipment protection. Provide this requirement in accordance with section 427.22 of the latest, applicable NEC.

F. Provide a complete system of self-regulating heat cable on all domestic water piping in crawl spaces, un-conditioned attic spaces, outdoors, and any other locations subject to freezing. Heat cable, accessories, and controls to prevent systems from freezing shall be UL Listed, CSA Certified, or FM Approved. Heat cable component enclosures shall be NEMA 4X rated to prevent external water ingress and corrosion. Heat cable shall conform to all requirements as specified in the Contract Documents under Division 26 (Electrical).

G. Heat cable shall be installed prior to insulation of the piping system and after all testing of the protected piping systems are complete. Heat cable shall be installed linearly along the bottom of the pipe and allowance shall be made for all fittings, valves, pipe supports, etc.

H. Heat cable shall be capable of maintaining a minimum water temperature of 40°F at an ambient air temperature of 0°F.

I. Heat cable shall be self-regulating type that responds to varying localized temperature conditions by varying the heat output along its length. This shall be accomplished by a self-regulating core which varies its resistance continuously with changes in temperature. A constant wattage heating method shall not be acceptable.

J. Provide an adjustable thermostat control which de-energizes the self-regulating heat cable when the ambient air temperature is above a set temperature. Default temperature setting of the thermostat control shall be set to de-energize when the ambient air temperature is above 40°F.

K. Installation shall not require the installing Contractor to cut into the heating cable core to expose the bus wires. Systems whose connection methods require the installing Contractor to strip the bus wires, use crimps, or use terminal blocks shall not be acceptable.

L. Provide all power connection hardware, splices, end seals, etc. to accomplish installation. All hardware shall be of the same manufacturer as the heat cable.

M. Provide a minimum of one (1) inch thick fiberglass insulation on all piping with heat cabling.

2.5 FLASHING

A. Vent pipes passing through roof shall be flashed watertight.

B. Roof connections shall meet the approval of the manufacturer of the roofing materials and shall comply with the roof bond requirements.

C. All vent piping shall be offset above ceilings or in attic spaces as required to penetrate roofs on the least-visible side(s) of the building.

2.6 FLOOR, WALL, AND CEILING PLATES

A. Furnish and install heavy gauge, chromium-plated, steel wall and ceiling plates on all exposed pipes in finished areas where piping passes through walls, ceilings, etc.

B. Plates shall be of the type that will remain permanently in position and, where pipes are insulated, they shall be of the size necessary to cover insulated piping.

2.7 DRAIN PAN

A. Acceptable manufacturers:

1. DiversiTech
2. Killarney Metals
3. Riverside Sheet Metal

B. Furnish and install eighteen (18) to twenty-four (24) gauge galvanized steel pan under all above grade plumbing piping in the electrical rooms, MDF rooms, and IDF rooms.

C. Furnish and install eighteen (18) to twenty-four (24) gauge galvanized steel pan for water heaters.

D. Drain pan shall have at least two (2) inches in depth and shall extend at least six (6) inches beyond the plumbing pipe or equipment.

E. Drain pan shall be installed at least six (6) feet above electrical panels and electrical gear for accessibility and maintenance clearances and shall be installed within six (6) inches below the plumbing pipe or equipment.

F. Provide steel strut channels and hangers for drain pan support.

2.8 TRACER WIRE

A. All trace wire and trace wire components shall be domestically manufactured in the United States of America.

B. All trace wire shall have HDPE insulation intended for direct bury and color-coded per APWA standards for the specific utility being marked.

C. All trace wire shall be provided for underground, non-metallic system mains four (4) inches and larger.

1. Trace wire shall be installed in the trench on top of the underground, non-metallic piping and then attached to a metal pipe above slab at the end of the run. The wire under Division 22 scope shall extend a maximum of five (5) feet outside the building exterior to an access point.

a. Access point shall be located such that it is easily accessible for maintenance personnel and in coordination with the surrounding Architectural and Civil elements.

D. Acceptable manufacturers:

1. Copperhead Industries

E. Trace wire (copper-clad steel):

1. Open trench installation: direct burial 12AWG, solid steel core, soft drawn tracer wire with 250 lbs. average tensile break load, thirty (30) mil high-density polyethylene jacket complying with ASTM D1248, and thirty (30) volt rating. Refer to Section 22 05 00, Subsection 3.8 “TRACER WIRE EXECUTION” for additional requirements and information. Provide Copperhead Industries “1230-SF” or an equal, accepted manufacturer.

2. Directional bore or jacketed installation: direct burial 12AWG, solid steel core, hard drawn, extra high strength, horizontal directional drill tracer wire with 1,150 lbs. average tensile break load, forty-five (45) mil high-density polyethylene jacket complying with ASTM D1248, and thirty (30) volt rating. Refer to Section 22 05 00, Subsection 3.8 “TRACER WIRE EXECUTION” for additional requirements and information. Provide Copperhead Industries “1245-HS” or an equal, accepted manufacturer.

F. Connectors (copper-clad steel):

1. Splices along the continuous run of trace wire for repair of a wire break or replacement of a filed segment of wire shall use 3M “Direct Bury Splice Kits” or

an equal, accepted manufacturer. Acceptable alternative products by other manufacturers shall be capable of securely connecting two or more wires, effectively seal against moisture by means of a dielectric, non-hardening, silicone sealant, be approved for direct burial, and be rated for a minimum of fifty (50) volts.

2. Branch connections for laterals, turnouts, services, and appurtenances shall use King Innovation “DryConn” Waterproof Direct-Bury Lug Connectors (Aqua) or an equal, accepted manufacturer. Acceptable alternative products by other manufacturers shall be capable of securely connecting one or two wires to the main trace wire without cutting the main trace wire, effectively seal against moisture by means of a dielectric, non-hardening, silicone sealant, be approved for direct burial, and be rated for a minimum of fifty (50) volts.

    a. The intent of this specification is to provide connection terminations at main branches serving separate buildings, separate sections of a building, turnouts, services, and appurtenances. The tracer wire shall be capable of continuing along all under slab main runs such that, when energized, the resulting tone continues for that part of the associated segment of the underground system.

3. Non-locking, friction fit, twist-on, and taped connectors shall not be acceptable. Twisting of copper wiring shall not be acceptable.

G. Termination and access (copper-clad steel):

1. Termination and access point shall be located a maximum of five (5) feet outside the building exterior. Provide Copperhead Industries “SnakePit” access point or equivalent product by alternative manufacturer that is compatible with the complete tracer wire system.

2. Terminal box shall be flush mount type for installation at grade level. Terminal box shall be specifically manufactured for such application.

3. Terminal box shall consist of tubular housing, terminal board, and removable round lid.

4. Minimum dimensions shall be five and one-half (5.5) inches diameter and eight (8) inches high. Base shall be sized to fit four (4) inch PVC Schedule 40 pipe.

5. Housing and terminal board material shall be high strength ABS or polycarbonate plastic. All materials of the construction shall be impervious to chemicals typically used for snow and ice removal as well as pavement and hardscape maintenance.

6. Housing and lid shall be designed for easy access and maintenance:

    a. Turf and landscape areas:

        1) Light-duty housing with plastic lid

    b. Hardscape areas:

        1) Heavy-duty housing with cast iron or ductile iron lid

    c. Roadway, driveway, and parking lot applications shall not be acceptable.

7. Terminal board shall have nickel-plated brass terminals. Terminal quantity for necessary and complete installation of the system shall be provided as required with a minimum of four (4) spare terminals provided.

H. Grounding (copper-clad steel):

1. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of twenty (20) feet of 14AWG, red, HDPE insulated, copper-clad steel wire connected to the anode (minimum 0.5 lbs.) that is specifically manufactured for such applications and shall be buried at the same elevation as the utility.

2. Drive-in magnesium anode shall be Copperhead Industries “ANO-1005” (1.5 lbs.) or an equal, accepted manufacturer.

2.9 PIPING SYSTEMS IDENTIFICATION

A. A marker showing the service and an arrow indicating the direction of flow shall be applied to the piping systems below and as applicable to the scope of work installed under this Division:

1. Acid (vent, waste)

2. Compressed air

3. Domestic water (cold, hot, hot return)

4. Gas

5. Heat trace

6. Non-potable

7. Sanitary (vent, waste)

8. Softened water

9. Storm drainage (primary, secondary)

B. Piping identification shall be applied to all piping systems in areas of exposed construction and in areas with accessible ceilings as well as in the following locations:

1. Both sides of each wall, floor, and ceiling penetration

2. Connections to equipment

3. Adjacent to valves and flanges

4. Adjacent to piping obstructed from view

5. Heat trace pipe runs at no more than ten (10) foot intervals or as required by the local code

6. Straight pipe runs at no more than twenty-five (25) foot intervals

C. Adhesive type labels shall not be acceptable, provide only “snap-around” or “snap-on” type labels.

D. The letter size, background color, and placement of markers shall conform to the requirements of ANSI/ASME A13.1 as well as all OSHA requirements. Identify all interior

exposed piping and all piping in chases or plenums with a plastic “snap-around” or “snap-on” label indicating pipe system type and direction of flow arrow. Contractor shall clean piping prior to plastic marker installation. Provide consistent manufacturer for plastic markers of each system such that marker background colors, arrows, and system description are visually identical. Each system shall be clearly identified with a minimum letter size of two and one-quarter (2.25) inches for pipe sizes up to four (4) inches and a minimum letter size of four (4) inches for pipe sizes larger than four (4) inches.

E. Acceptable manufacturers:

1. Seton Nameplate Corporation

2. Brady Corporation

F. Each valve in the Division 21 and Division 22 systems shall be tagged with an individual number stamped onto the valve’s tag. Provide identification tags on all emergency fixtures and equipment shut-off valves.

G. Valve tags shall be brass or plastic laminate, a minimum diameter of one and one-half (1.5) inches, and shall have a brass chain with hook for securing the valve tag to the valve.

H. Valve tags shall include “P” or “FP” lettering designation to indicate the appropriate plumbing or fire protection system, respectively. Valve tag numbering shall be consecutive for each service of the plumbing or fire protection systems.

I. Provide a printed, compiled list or schematic drawing for each system indicating the tagged locations as well as a detailed description of the system or equipment being served.

J. Provide one (1) copy of each list or drawing that shall be framed and mounted at the location designated by the Building Engineer. Provide an additional copy of each list which shall be included in the O & M manual.

2.10 EQUIPMENT LABELING

A. All equipment shall be labeled; this shall include all pumps, water heaters, storage tanks, compressors, water treatment systems, utility controllers, and other similar equipment.

B. Equipment labeling shall be completed with the following items, unless noted or specified otherwise:

1. Submit schedule of equipment to be included and their designations.

2. Provide nameplates with one-half (0.5) inch high letters and fastened with epoxy or screws.

PART 3 – EXECUTION

3.1 OWNER INSTRUCTION – GENERAL

A. Provide on-site Owner training for all new equipment by factory trained specialists.

B. Use O & M manuals and actual equipment installed as the basis for instruction.

C. At conclusion of on-site training program, the Contractor shall have Owner personnel sign written certification that they have completed training and understand equipment operation. Include copy of training certificates in final O & M manual.

D. No retainage shall be released until the Owner has received all O & M manuals and as-built drawings as well as performed a first O & M walk.

E. Refer to individual equipment specifications for additional training requirements.

3.2 INSTRUCTION OF OWNER PERSONNEL

A. Prior to final inspection, the Contractor shall conduct an on-site training program to instruct the Owner's operating personnel of the operation and maintenance for the installed plumbing systems.

1. Provide the training during the Owner's regular working hours.

2. The instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems with the project.

B. Time to be allocated for on-site training program:

1. Minimum of eight (8) hours dedicated instructor time

2. Minimum of four (4) hours per day for two (2) days

C. Before proceeding with the on-site training program, the Contractor shall submit the program syllabus, proposed times and dates, and other pertinent information for review and approval by means of:

1. One (1) copy to the Owner

2. One (1) copy to the Architect

3. One (1) copy to the Engineer

D. The Owner will provide a list of personnel to receive instructions and will coordinate their attendance at the agreed upon times.

E. Use the O & M manuals as the basis of instruction. Review contents of manual in detail with personal to explain all aspects of operation and maintenance.

F. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each equipment item.

G. Demonstrate equipment functions both individually and as part of the total, integrated system.

H. Prepare and insert additional data into the O & M manual when the need for additional data becomes apparent during instruction and training.

I. Submit a report within one (1) week after completion of the on-site training program that demonstrations and instructions have been satisfactorily completed. Provide time, date, and hours devoted to each demonstration and instruction with a list of personnel in attendance.

J. At the conclusion of the on-site training program, the Contractor shall have an Owner-designated individual sign a certificate to certify that they have a proper and thorough understanding of the demonstrated and instructed systems. By signing the certificate, the individual agrees that all demonstrations and instructions have been satisfactorily completed regarding the scope and content of the O & M manuals used in the on-site training program.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each O & M manual.

3.3 GENERAL REQUIREMENTS

A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections required for a complete and satisfactory startup.

B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed in such a manner and sequence as to avoid damage of components and as required by jobsite progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical, mechanical, technology, and architectural work. Equipment, accessories, and similar items requiring normal servicing or maintenance shall be easily accessible.

C. The Engineer reserves the right to direct the removal of any item which, in their opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.

D. Mounting heights, unless otherwise noted, are to the finished bottom of the device.

3.4 STORAGE AND PROTECTION OF MATERIALS

A. During construction, all equipment shall be properly protected against damage, defacing, and freezing with manufacturer supplied or recommended shipping cartons, plastic sheeting, shipping covers, etc.

B. All open ends of piping and equipment shall be sealed with nipples, caps, plugs, and test plugs until final connection(s) to the system is made.

C. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction with protective covers at the following instances:

1. Floor sink opening: Protect and cover with heavy-duty plywood or heavy-duty plastic cover by SmartGuard.

2. Floor drain opening: Protect and cover with heavy-duty plastic cover by SmartGuard.

3. Cleanout opening: Protect and cover with heavy-duty plastic cover by SmartGuard.

4. Pipe opening: Protect and cover with heavy-duty plastic cover by SmartGuard.

5. Fixture opening(s): Protect and cover with plastic sheet cover until final punch list.

D. Handle and store materials in accordance with the manufacturer and supplier recommendations and in a manner preventing damage to the materials during storage and handling. Replace all damaged materials.

E. Equipment and materials shall not be installed until the environmental conditions of the jobsite are suitable to satisfactorily protect the equipment and materials. Equipment and materials damaged or subjected to adversarial environmental conditions shall not be acceptable and shall be removed from the jobsite and replaced accordingly.

F. Use of duct tape or other similar protection methods shall not be acceptable.

3.5 EXCAVATION, TRENCHING, AND BACKFILLING

A. The Contractor shall perform all excavation required to install the work specified herein and as indicated on the Drawings. During excavation, material for backfilling shall be piled back from the trench banks to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for the backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and excavated areas. Any water accumulation therein shall be removed via pumping. All excavation shall be made by open cut. Tunneling and boring shall not be acceptable except underneath pavement.

B. The bottom of the trenches shall be graded to provide uniform bearing and supports for piping, fittings, etc. on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth and tamped in twelve (12) inch layers. Remove unstable soil that is not capable of supporting equipment or installation and replace with the specified material for a minimum of twelve (12) inches below invert elevation of the equipment or installation.

C. The Contractor shall coordinate and provide pipe supports as required per structural Drawings for any void form system such as piping under the slab, piping exiting the building, special requirements on the backfill, etc. and as such all piping shall be supported by an approved, suspended system.

1. System structure:

   a. Provide a dimensionally stable underground void space that is independent from the overhead structural slab. The subterranean system shall support the weight of suspended lateral pipes, including all imposed loads, throughout the construction process.

   b. The system shall be designed to have the ability to temporarily position and suspend the lateral pipes to the specified height and slope until permanently anchored to the overhead structural slab via securing hanger system. The open, underground system then remains independent from the securing hangers.

   c. The open space of the system beneath the structural slab is designed to receive infill of vertical expansion from the underlying soils. If vertical pressure is applied to the edges of the system in contact with the soil, the uplifting soil pressure will become separate and allow the lateral pipes to be totally independent from the system.

2. System components:

   a. The system shall maintain its structural integrity in all humid environment conditions and shall have waterproof components appropriate for its intended performance. All system components, excluding all thread rods, nuts, and washers, shall be furnished by the system manufacturer.

   b. All vertical all thread rods shall have a component secured toward the top end and permanently affixed into the concrete slab to maintain the specified elevations.

c. System shall be installed per the manufacturer's requirements and recommendations. The Contractor shall coordinate the system installation with the structural Drawings and the manufacturer guidelines as required.

D. The trenches shall be backfilled with cement-stabilized sand materials approved for backfill purposes, deposited in six (6) inch layers, and tamped until the crown of the pipe is covered by a minimum of six (6) inches of material.

1. Provide a sand-cement mixture producing a minimum unconfined compressive strength of one hundred (100) PSI in forty-eight (48) hours.

a. Design shall be based on strength specimens molded in accordance with ASTM D588 at a moisture content within three (3) percent of optimum and within four (4) hours of batching.

b. Determine minimum cement content from product data and statistical history. Provide no less than one and one-tenth (1.1) sacks of cement per ton of dry sand.

2. Cement: Portland cement Type I conforming to ASTM C150

3. Sand: Clean, durable sand meeting the grading requirements for fine aggregates of ASTM C33 and the following requirements:

a. Classified as SW, SP, SW-SM, SP-SM, or SM by the Unified Soil Classification System of ASTM D2487.

b. Deleterious materials:

1) Organic impurities colored no darker than the standard color and conforming to the requirements ASTM C40.

2) Lightweight pieces less than five (5) percent and conforming to the requirements of ASTM C123.

3) Clay lumps less than one-half (0.5) percent and conforming to the requirements of ASTM C142.

c. Plasticity index of four (4) or less when tested in accordance with the requirements of ASTM D4318.

E. Provide a layer of sand at least six (6) inches deep under all plastic pipe installed in soil. Bell end of pipe shall be excavated to ensure that the pipe rests for its entire length upon a solid trench bottom.

F. The backfill under and beside the pipe shall be compacted for pipe support. The backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by the code, the material shall be installed in accordance with the more restrictive requirements. The backfill process shall be carried out simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to ninety-five (95) percent of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water shall not be acceptable. Reopen any trenches not meeting compaction requirements or, where settlement occurs, the Contractor shall refill, compact, and restore the surface to the grade and compaction indicated as well as mounded over and

smoothed off. A metallic-lined, underground warning tape shall be provided twelve (12) inches below finished grade. The warning tape shall be identifiable as to the type of line per OSHA and ANSI standard nomenclature and color.

G. Perform all excavation and backfill work in accordance with the applicable portions of the earthwork sections of the code.

3.6 TRACER WIRE EXECUTION

A. Trace wires shall be installed adjacent to nonmetallic underground water, gas, and main sewage lines underneath the building pad and stubbed up into a ground access well enclosure for the trace wire to connect to it. Trace wire shall be color coded for piping systems as follows:

1. Natural gas: yellow
2. Sanitary sewer: green
3. Storm sewer: green
4. Water (potable): blue
5. Water (non-potable): purple

B. Install trace wire as required by this Section and in accordance with the local codes:

1. Trace wire shall be installed in the same trench as its associated piping and shall be installed inside bored holes and casing with pipe during pipe installation. Trace wire shall be secured to the pipe as required to ensure that the wire remains adjacent to the pipe. The trace wire shall be securely bonded together at all wire joints with an approved, watertight connector to provide electrical continuity and shall be accessible at all trace wire access points.
2. Prior to backfill, install trace wire on top of pipe and secure in place with ties or hitches at a maximum of ten (10) foot intervals and in accordance with the local jurisdiction’s water utility requirements. Run trace wire continuously along the pipe and terminate at access points. Where buried splices occur, use an approved electrical splicing kit only. Provide no less than twenty-four (24) inches of coiled wire at access points for attachment to pipe-locating equipment. Each installed pipe run shall be capable of being located using the trace wire system. Protect wire insulation from damage during installation and backfill. Wire insulation that is broken, cut, or damaged shall be replaced.
3. At the point of connection between existing, conductive pipes, the trace wire shall not be connected to the conductive pipe. This circumstance shall be treated as a mainline dead-end grounded using an approved, waterproof connection to a grounding anode and buried at the same depth as the trace wire. All such connections points shall be grounded.
4. Where existing trace wire is encountered on an existing pipe run that is being extended or tied into, the new and existing trace wire shall be connected using approved splice connectors, shall be properly grounded at the splice location(s) as specified, and shall be completely waterproof to prohibit corrosion and loss of conductivity.
5. Trace wire shall be laid flat and securely affixed to the pipe at the three (3) o’clock position. The wire shall be protected from damage during execution of the

work. No breaks or cuts in the trace wire or trace wire insulation shall be permitted. At service saddles, placing the trace wire between the saddle and the main shall not be acceptable.

6. At all main end caps, a minimum of six (6) feet of trace wire shall be extended beyond the end of the pipe, coiled, and secured to the cap for future connections. The end of the trace wire shall be spliced to the wire of a six (6) lbs. zinc anode and buried at the same elevation as the pipe main.

7. Trace wire access points shall be accessible at all new water valve boxes. Concentrations of multiple proposed valve boxes near pipe intersections, e.g., tees and crosses, may require more than one access point assembly in each concrete valve box collar.

8. At the point of connection between ductile iron water mains and any dissimilar material, the trace wire shall be properly connected to the iron pipe with a “Cadweld” or approved equivalent. Trace wire welds shall be completely sealed with the use of an approved, mastic-type sealer specifically manufactured for installation at below grade. Mastic shall be applied in a thick coat at a minimum of one-quarter (0.25) inch in thickness and shall be protected from contamination by the backfill material with the use of a plastic membrane.

9. Trace wire systems shall be installed as a single continuous wire except where approved connectors are used. Looping or coiling of the wire shall not be acceptable.

10. Any damage occurring during the installation of the trace wire shall be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping or spray coating shall not be acceptable.

11. Open trench installation:

    a. Trace wire shall be placed a minimum of eight (8) inches above buried natural gas piping and nonmetallic piping for any service. For other utility piping systems, trace wire shall be laid directly upon pipe and attached at a maximum of ten (10) foot intervals with non-conductive tape. Additional attachment(s) shall be provided at offsets and fittings in the piping system. Trace wire shall be placed carefully, and great care shall be exercised during the backfill process to maintain physical integrity and position relative to piping.

    b. Splices in trace wire shall be kept to an absolute minimum. When splices are necessary, they shall be made with approved trace wire connectors as specified. Other splicing methods shall not be acceptable.

12. Directional bore or jacketed installation:

    a. Two (2) trace wires shall be provided with one (1) wire as backup.

    b. Trace wires shall be pulled through bore hole(s) in conjunction with utility piping. Wires shall be located on opposite sides of utility piping.

    c. Trace wire splices shall not be acceptable in drilled sections.

13. Trace wires shall be interconnected at intersections of mainlines and branches utilizing a single three-way connector at each point of connection.

14. A terminal box shall be provided at each building utility service entrance and shall be located above piping within five (5) feet of the point of entry into the building.

15. Terminal boxes shall not be located more than one thousand (1,000) linear feet of developed pipe length apart.

16. Terminal boxes shall not be installed at streets, drives, parking lots, or other areas subject to vehicular traffic.

17. Terminal boxes shall not be installed at areas where access to the box is impeded.

18. Terminal boxes shall be installed flush with finished grade and centered in grade-level concrete pads. Concrete pad shall be 18” X 18” minimum and shall be six (6) inches thick.

19. PVC pipe risers shall be firmly attached to the bottom of the terminal box housing and extended downward to an elevation approximately twelve (12) inches above piping. Riser shall serve as a vertical conduit for guiding trace wires into the bottom of the terminal box.

20. Care shall be taken to extend trace wire from utility pipe to the terminal box in an orderly and workmanlike manner as backfill is placed.

21. The end of each trace wire shall be properly landed on a dedicated terminal within the terminal box(es) and securely tightened. Twelve (12) to eighteen (18) inches of excess length shall be provided for each wire within a box. Each terminal shall be clearly identified with permanent labeling. Where trace wires for multiple utilities are terminated, care shall be taken to ensure accuracy of identification at both ends.

C. Testing:

1. All new trace wire installations shall be located using typical low frequency (512 hertz) line tracing equipment and witnessed by the Contractor, Engineer, and Owner’s designated representative prior to acceptance of ownership.

2. The verification shall be performed upon completion of rough grading and again prior to final acceptance of ownership.

3. Final testing of each trace wire shall be performed after the backfill process is complete, terminal boxes have been permanently installed, and wires are terminated. Testing shall be witnessed by the Architect, Engineer, and Owner’s designated representative. It may be advisable for the Contractor to perform preliminary test(s) during utility installation prior to final backfill and restoration. Testing shall be accomplished using typical low frequency line tracing equipment. Continuity testing in lieu of actual line tracing shall not be acceptable.

D. Perform all excavation and backfill work in accordance with the applicable portions of the earthwork sections of the code.

3.7 CONCRETE WORK

A. Construct curbs, pads, vaults, and similar supports for equipment where required.

B. First floor and equipment yard: provide a minimum of six (6) inch thick housekeeping pads at floor mounted equipment and a minimum of four (4) inches larger than the entire area occupied by equipment.

C. Second floor and above: provide a minimum of four (4) inch thick housekeeping pads at floor mounted equipment and a minimum of four (4) inches larger than the entire area occupied by equipment. Dowel pads to the structural slab.

D. Perform all concrete work in accordance with applicable portions of the concrete sections of the code. Minimum compressive strength of concrete shall be the same as specified for slabs on grade.

3.8 CLEANING OF PIPING SYSTEMS

A. Provide cleaning of installed piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to completely clean, purge, and circulate the system as required.

B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, fixtures, etc. shall be thoroughly cleaned both inside and out with the following minimum requirements:

1. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line-size blow down ball valve and pipe to nearest drain. Blow down, remove, and clean strainers as frequently as necessary.

2. Phase I: Initial flushing of systems. Remove loose dirt, mill scale, weld beads, rust, and other deleterious substances without damage to the system components. Open valves, drains, vents, and strainers at all system levels during flushing procedures. Flush until potable water is clear and particles larger than five (5) microns are removed. Connect dead-end supply and return headers, even if not shown on the Drawings, and provide terminal drains in bottom of pipe end caps or blind flanges. Dispose of water in an approved manner.

3. Phase II: Cleaning of piping systems. Remove, without chemical or mechanical damage to any system component, adherent dirt, organic soil, hydrocarbons, soldering flux, mill varnish, piping compounds, rust, and other deleterious substances not removed by initial flushing. Flush system and replace with clean, potable water.

4. Phase III: Final flushing and rinsing of systems. Flush and rinse until potable water is clear and particles larger than five (5) microns) are removed. Operate valves to dislodge any debris in the valve body. Dispose of water in an approved manner.

5. Submit status reports upon completion of each phase of work on each system.

3.9 TESTING OF PIPING SYSTEMS

A. General:

1. Prior to insulation and concealment, all piping systems shall be subjected to testing with water or air as noted and shall hold tight at the pressure head stated

for the time interval required without adding air or water. While any system is being tested, required head or pressure shall be maintained until all joints are inspected.

2. All tests shall be witnessed by the inspector having jurisdiction and the Owner's designated representative with a minimum of forty-eight (48) hours' notice given to the parties involved.

3. All equipment, material, labor, and testing mediums required for testing any of the various systems or any part thereof shall be furnished by the Contractor.

4. All connected fixtures, equipment, accessories, etc. shall be isolated from the piping systems prior to testing.

B. Sanitary piping system:

1. Water test shall be applied to these drainage systems either in their entirety or in sections as required after rough piping has been installed. If the system is tested in sections, each opening shall be tightly closed except the highest opening in the section enduring testing. All sections shall be tested with a minimum of ten (10) feet of head. In testing successive sections, at least the upper ten (10) feet of the next section shall be tested so that no piping joint in the building shall undergo a test consisting of less than ten (10) feet of head. The water shall be successfully kept in the system for at least thirty (30) minutes before inspection begins. The system shall then be made tight at all points.

2. Any point(s) of the drainage systems to be tested with air instead of water shall be performed by attaching a compressed air testing apparatus to any suitable opening and, after closing tight all other inlets or outlets, forcing air into the system until there is a minimum gauge pressure of five (5) PSI. This pressure shall be held without the introduction of additional air for a period of at least thirty (30) minutes.

3. Exterior connections shall be tested as part of the interior systems.

C. Interior water piping system:

1. Upon completion of the entire water supply system or a section of it as required, the system shall be tested prior to connection of fixtures, equipment, accessories, etc. and proved tight under a water or air pressure test of at least one hundred and fifty (150) PSI. Pressure shall hold for a period of one (1) hour without introducing additional water or air. Water used for testing shall be from a potable supply source. Defective joints or piping shall be replaced as required and all piping shall be retested as required.

D. Compressed air system:

1. All compressed air piping shall be tested to one hundred and fifty (150) PSI for a period of two (2) hours.

E. Defective work:

1. If inspection or tests show defects, such defective work or material shall be replaced, and the inspections and tests shall be repeated. All repairs to piping shall be made with new material. Caulking of screwed joints or holes shall not be acceptable.

F. Additional tests:

1. Provide all additional tests such as smoke, pressure, etc. as required by the regulations or as directed by jurisdictional authorities making the inspection.

2. Provide for any repeated test as directed by the Owner's designated representative to ensure all systems are tight as required.

3. Visual inspections of joints, valves, etc. shall be made as directed by the Engineer.

3.10 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and performance through the range of its operations. Tests shall be made in the presence of the Architect and Engineer. Provide adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under their respective Specification Sections.

B. Submit three (3) copies of all certifications and test reports in a timely manner ahead of work completion to allow adequate time for remedial action as required to correct deficiencies discovered in the equipment and plumbing systems.

3.11 DISINFECTION OF INTERIOR AND EXTERIOR WATER SYSTEMS

A. Prior to project completion, all potable water piping systems shall be disinfected per local code requirements.

B. Whenever the authorities having jurisdiction do not specify disinfection procedures, the new water piping system shall be thoroughly disinfected with a solution containing not less than fifty (50) parts per million of chlorine. The chlorinating solution shall be liquid chlorine of sodium hydrochloride solution and shall be introduced and drawn to all points in the system. The disinfecting solution shall be allowed to remain in the system for a period of eight (8) hours, during which period all valves and faucets shall be opened and closed several times. After disinfection, the solution shall be thoroughly flushed from the system with clear, potable water until the residual chlorine content is no more than two-tenths (0.2) parts per million.

C. This work shall be supervised or performed by an approved chemical testing laboratory and the results shall be sent to the Engineer or their representative for verification.

3.12 OPERATION AND MAINTENANCE MANUALS

A. Form of manuals:

1. Prepare data in the form of an instructional manual for use by the Owner's personnel.

2. Format:

a. Size: Letter size (8.5" X 11").

b. Text: Manufacturer's printed data or neatly typewritten equivalent.

3. Drawings:

a. Provide reinforced punched binder tab and bind in text.

b. Fold larger drawings to be of at least the same format size as specified hereinbefore.

4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.

5. Cover:

a. Identify each volume with the printed title, “Operating & Maintenance Instructions” and include the following elements:

1) Title of project

2) Identity of separate structures or facilities as applicable

3) Identity of general subject matter covered in that specific volume

6. Bind as specified.

B. Content of manuals:

1. Provide a neatly typewritten table of contents for each volume, arranged in a systematic order as outlined in the Specifications, and include the following elements:

a. The Contractor name, name of responsible principal, address, and telephone number

b. Each product required to be included in the table of contents and indexed appropriately to the content of the volume

c. Each product’s associated address, telephone number, and name of:

1) The Subcontractor or installer

2) Maintenance Contractor, if applicable

3) Identify areas of responsibilities for each party

4) Local source of part supplies and part replacement

d. Identify each product by the product name and other identifying symbols as set forth in the Contract Documents.

2. Product data:

a. Include sheets pertinent to the specific product.

b. Annotate each sheet to:

1) Identify specific product or part installed

2) Identify data applicable to installation

3) Delete references to inapplicable information

a) All options not supplied with equipment shall be marked out or indicated in some manner.

3. Drawings:

a. Supplement product data with drawings as necessary to illustrate:

1) Relations of component parts of equipment and systems

2) Controls and flow diagrams

b. Coordinate drawings with information in the Project Record Documents to assure correct illustration of completed installation.

c. Do not use the Project Record Documents as maintenance drawings.

4. Written text, as required to supplement product data for a specific installation, shall include:

a. Separate headings for different procedures and organized in a consistent format

b. Logical sequence of instructions for each procedure

5. Copy each warranty, bond, and service contract issued.

a. Provide an information sheet for the Owner's personal indicating:

1) Proper procedures in the event of failure

2) Instances that might affect validity of warranties or bonds

6. Shop drawings, coordination drawings, and product data as specified.

C. Sections for equipment and systems:

1. Content for each unit of equipment and system as applicable:

a. Description of unit and component parts:

1) Function, normal operating characteristics, and limiting conditions

2) Performance curves, engineering data, and tests

3) Complete nomenclature and commercial number of replaceable parts

b. Operating procedures:

1) Startup, break-in, routine, and normal operating instructions

2) Regulation, control, stopping, and emergency shutdown instructions

3) Summer and winter operating instructions

4) Special operating instructions

c. Maintenance procedures:

1) Routine operations

2) Guide to troubleshooting

3) Disassembly, repair, and reassembly

4) Alignment, adjusting, and checking

5) Routine service based on operation hours

d. Servicing and lubrication schedule as well as a list of lubricants required.

e. Manufacturer's printed operating and maintenance instructions.

f. Description of sequence of operation by the controls manufacturer.

g. Installed equipment and system control diagrams by the controls manufacturer.

h. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance. Include:

1) Predicted life of each part subject to wear

2) Items recommended to be stocked as spare parts

i. Complete equipment internal wiring diagrams.

j. Each Contractor's coordination drawings.

k. Color-coded piping diagrams of the installed equipment and systems.

l. Charts of valve tag numbers with location and function of each valve.

m. Other data as required under relevant sections of the Specifications.

2. Prepare and include additional data when the need for such data becomes apparent during instruction of the Owner's personnel.

3. Additional requirements for operating and maintenance data as outlined in relevant sections of the Specifications.

4. Provide complete information for products specified in Division 22.

5. Provide certificates of compliance as specified in each related section of the Specifications.

6. Provide startup reports as specified in each related section of the Specifications.

7. Provide signed receipts for spare parts and materials.

8. Provide training report and certificates.

9. Provide backflow preventer certification test reports.

10. Provide gas piping pressure test reports.

END OF SECTION 22 05 00

SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Expansion joints.
2. Pipe alignment guides.
3. Pipe anchors.

B. Related Sections:
1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and installation requirements for piping hangers and supports.

1.3 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:
1. Installation Temperature: 50 degrees Fahrenheit.
2. Domestic Hot Water: 140 degrees Fahrenheit.
3. Safety Factor: 30 percent.

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Submit shop drawings sealed by a registered professional engineer.

C. Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Design Data: Indicate criteria and show calculations. Submit calculations sealed by a registered professional engineer.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders’ Certificate: Include welders’ certification of compliance with AWS D1.1.

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

B. Operation and Maintenance Data: Submit adjustment instructions.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

B. Design expansion compensating system under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

B. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.9 WARRANTY

A. Furnish five (5) year manufacturer warranty for leak free performance of packed expansion joints.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Manufacturers:
1. Amber / Booth
2. Triplex
3. Mason Industries
4. Uponor

B. Stainless Steel Bellows Type:
1. Pressure Rating: 200 psig WOG and 250 degrees Fahrenheit.
2. Maximum Compression: 1-3/4 inch.
3. Maximum Extension: 1/4 inch.
4. Joint: As specified for pipe joints.
5. Size: Use pipe sized units
6. Application: Steel piping three (3) inch and smaller.

C. External Ring Controlled Stainless Steel Bellows Type:

1. Pressure Rating: 200 psig WOG and 250 degrees Fahrenheit.
2. Maximum Compression: 15/16 inch.
3. Maximum Extension: 5/16 inch.
4. Maximum Offset: 1/8 inch.
5. Joint: Flanged
6. Size: Use pipe sized units
7. Accessories: Internal flow liner.
8. Application: Steel piping three (3) inch and larger.

D. Double Sphere, Flexible Compensators:
1. Body: Multi-layered Kevlar tire cord fabric reinforced with EPDM cover, liner and fabric frictioning with reinforcing ring.
2. Working Pressure: 215 psi
3. Maximum Temperature: 250 degrees Fahrenheit.
4. Maximum Compression: 1-1/4 inch through 6 inch pipe; 1-1/2 inch 8 inch through 12 inch; 1-1/5 inch for 14 inch.
5. Maximum Elongation: 3/4 inch through 6 inch pipe; 1-1/2 inch 8 inch through 12 inch; 5/8 inch for 14 inch.
6. Maximum Offset: 3/8 inch through 6 inch pipe; 7/8 inch 8 inch through 12 inch; 1 inch for 14 inch.
7. Maximum Angular Movement: 15 degrees.
8. Joint: Steel flanges or ductile iron pipe flanges.
9. Size: Use pipe sized units
10. Accessories: Control rods.
11. Application: Steel piping two (2) inch and larger.

E. PEX-a Pipe Support (Uponor):
1. For use with Uponor PEX-a pipe
2. PEX-a pipe continuously supported with PEX-a Pipe Support and utilizing fixed anchor points every:
   a. 65 feet for domestic hot water
   b. 150 feet for domestic cold water
3. Utilize the included stainless-steel straps to secure the PEX-a Pipe Support to the pipe at the intervals specified in the manufacturer's installation instructions.
4. Refer to the Uponor Plumbing Design Assistance Manual for more information.

2.2 ACCESSORIES

A. Manufacturers:
1. Amber / Booth
2. Triplex
3. Mason Industries

B. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine piping layout and notify the Architects/Engineers of additional anchors or expansion joints required to adequately protect system.

B. Provide inspection services by flexible pipe manufacturer's representative for final installing and certify that installation is in accordance with manufacturer's recommendations and that connectors are performing satisfactorily.

3.2 INSTALLATION

A. Install Work in accordance with ASME B31.9.

B. Install piping to allow for expansion and Contraction without stressing pipe, joints or connected equipment.

C. Flexible piping shall not be used in concealed spaces. Access panel shall be provided for concealed space installation.

D. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 23 05 29 for pipe hanger installation requirements.

E. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

F. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.

G. Provide expansion loops as per pipe manufacturers design guideline or as indicated on Drawings. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so that movement takes place along axis of pipe only. Rigidly anchor pipe to building structure to prevent stresses and transfer of loading to connected equipment.

H. Install expansion compensating devices for PEX tubing in accordance with the manufacturer’s installation instructions.

I. Coordinate with installation of piping seismic braces so they do not interfere with thermal expansion loop action or building joint loop action.

END OF SECTION 22 05 16

SECTION 22 05 29 - PLUMBING HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide a complete system of pipe hangers and supports for all plumbing and fire protection equipment and piping.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SUBMITTALS

A. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
   2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

B. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

C. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees Fahrenheit.

B. Maintain this minimum temperature before, during, and for minimum three (3) days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Unistrut Corp.
2. Portable Pipe Hangers.
3. Anvil/Anvil Strut.

B. Pipe Supports:
1. Conform to MSS SP58.
2. Hangers for Pipe sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe sizes two (2) inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe sizes three (3) inches and Smaller: Cast iron hook.
6. Wall Support for Pipe sizes four (4) inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
9. Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
10. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
12. Non-metallic pipe support: Vinyl-coated Hangers.
13. PEX Tube Support: CTS sized hangers or supports free of sharp edges.
14. Galvanized steel to be used for outdoor installation.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

B. Provide locking nuts on all rod extensions.

C. Galvanized steel to be used for outdoor installation.

2.3 INSERTS

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 SLEEVES AND ESCUTCHEONS

A. The Contractor shall furnish and set pipe sleeves and inserts for all work under this section and shall be responsible for their proper and permanent location. In the event that failure to do so requires cutting and patching, the remedial work shall be the responsibility of the Contractor.

B. All pipes passing through floors, walls or partitions shall be provided with sleeves having an internal diameter 1-1/2" (3/4" annular space) larger than the outside diameter of the pipe or insulation on covered lines, except as otherwise specified herein.

C. Sleeves for Pipes through Non-fire Rated Floors and Walls: 18 gage thick galvanized steel. Sleeves for all pipes through walls, beams and partitions shall finish flush with the finish line of the walls, beams and partitions.

D. Sleeves for all piping shall extend 1/2" above finish floor, (except where under partitions, the sleeves shall be flush with the bottom of the partition) and after the installation of pipe shall be packed and made watertight with fire stopping sealant to maintain separations and fire ratings.

E. Where pipes pass under footings and through exterior walls, sleeves shall be of galvanized steel pipe and shall be not less than 4" larger than the pipe being sleeved. Sleeves shall be made watertight where passing through waterproofed surfaces, exterior wall, and floor slabs on grade. Waterproofing shall be done by means of a steel slip on welding flange, continuously welded at the center of the sleeve and shall be painted with one coat of bitumastic paint inside and outside. The space between sleeve and pipe shall be packed with oakum to within 2" of each face of the wall; (to within 2" of the top of sleeve at floors). The remaining space shall be packed and made watertight with a waterproof mastic. Mechanical expansion type rubber seals such as manufactured by Calpico Ind. and Thunderline Corporation are acceptable as alternate method of water proofing piping penetrations.

F. Sleeves through floors or interior masonry walls shall be of galvanized steel pipe or wrought iron pipe size except where located in concealed pipe spaces where they may be of 22 gauge galvanized sheet steel if fire rating is maintained.

G. Sleeves for piping to receive insulation shall be large enough to allow continuous insulation through sleeves.

H. Spacing between or location of pipe sleeves in floor slabs, structural beams or structural walls shall be subject to the Structural Engineer’s approval.

I. Where pipes pass under load bearing footings they shall pass through a coated steel pipe sleeve as described above and extend past a 45 degree line out from the bottom of the load bearing structure. Concrete shall be used as backfill in the portions of trench within the 45 degree pressure line.

J. Provide chrome plated escutcheon plates on pipes passing through walls, floors, and ceilings exposed to view. Escutcheons shall be of sufficient outside diameter to cover the sleeve opening and shall fit snugly around the insulated or bare pipe and to the wall, partition, floor or ceiling. Provide stainless steel sheet metal for exterior walls. Welded water ring sleeve shall be used on all exterior wall and floor penetrations.

K. Sealant: Acrylic

2.5 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc., or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected

with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Unistrut Corp., or approved equal.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.7 FIRESTOPPING

A. Manufacturers:
   1. Dow Corning Corp. Model.
   2. 3M fire Protection Products Model.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Multiple component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Dark gray Black As selected from manufacturer’s full range of colors.

D. Plastic Tube and Pipe: Ensure that the appropriate firestop assembly is used for plastic piping systems. Refer to manufacturer’s system selector for more information.

2.8 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
   1. Mineral fiberboard.
   2. Mineral fiber matting.
   3. Sheet metal.
   4. Plywood or particle board.
   5. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish UL listed products or products tested by independent testing laboratory.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials to arrest liquid material leakage.

D. Do not drill or cut structural members.

E. Do not crush insulation with pipe clamp. Provide high density pipe insulation to accommodate pipe clamp or hanger.

F. Do not attach beam clamp on to bottom of steel joist.

3.2 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe four (4) inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 58.

B. Supports for Gas Piping:
1. Horizontal supports for steel and copper gas piping, threaded or welded, are every six (6) feet for 1/2 inch, every eight (8) feet for 3/4 inch and one (1) inch, and every ten (10) feet for 1-1/4 inches or larger.
2. Vertical supports for steel gas piping, threaded or welded, are every six (6) feet for 1/2 inch, eight (8) feet for 3/4 inch and one (1) inch, and every floor for 1-1/4 inch and larger.

C. Supports for Cast Iron Piping:

1. Vertical Piping:
   a. Support vertical piping and tubing at base and at each floor.
   b. Secure vertical piping at sufficiently close intervals to keep the pipe in alignment and to support the weight of the pipe and its contents. Support stacks at their bases and at sufficient floor intervals to meet the requirements of local codes. Approved metal clamps or hangers should be used for this purpose.
   c. When vertical piping is to stand free of any support or if no structural element is available for support and stability during construction, secure the piping in its proper position by means of adequate stakes or braces fastened to the pipe.
2. Horizontal Piping, Suspended:
   a. Support horizontal piping and fittings at sufficiently close intervals to maintain alignment and prevent sagging or grade reversal. Support each length of pipe by an approved hanger located not more than 18 inches from the joint.
   b. Support terminal ends of all horizontal runs or branches and each change of direction or alignment with an approved hanger.
   c. Provide hangers as necessary to provide alignment and grade. Provide hangers at each horizontal branch connection. Adequate provision should be made to prevent shear. Where pipe and fittings are suspended in excess of eighteen inches by means of non-rigid hangers, a sway bracing to be provided.
   d. An anchor or bracing to be provided on all storm drain pipe fittings.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment.
5. Support horizontal cast iron pipe adjacent to each hub, with five (5) feet maximum spacing between hangers. Support hubless cast iron at every other joint unless over four (4) feet then support at each joint. Support copper every six (6) feet for 1-1/2 inch and smaller; every ten (10) feet for two (2) inches and larger.
6. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
8. Support riser piping independently of connected horizontal piping.

D. Supports for copper tubing:
1. The following maximum horizontal spacing and minimum rod diameters:
   a. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   b. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   c. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   d. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
   e. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
   f. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
   g. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod
2. Install supports for vertical copper tubing every 10 feet (3 m).
3. Support vertical piping and tubing at base and at each floor.

E. Supports for steel piping:
1. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

a. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
b. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
c. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
d. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
e. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
f. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
g. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
h. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

2. Install supports for vertical steel piping every 15 feet (4.5 m).
3. Support vertical piping and tubing at base and at each floor.

F. Supports for stainless-steel piping:
1. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
a. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
b. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
c. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
d. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
e. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
f. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
g. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
h. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
2. Install supports for vertical steel piping every 15 feet (4.5 m).
3. Support vertical piping and tubing at base and at each floor.

G. Supports for CPVC piping:
1. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
a. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
b. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
c. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
d. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
e. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
f. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
2. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.
3. Support vertical piping and tubing at base and at each floor.

H. Supports for PEX tubing:
1. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

a. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod. Or
b. ¾" and smaller: 72 inches when a continuous support channel is used.
c. 1" and larger: 96 inches when a continuous support channel is used.

2. Support vertical piping and tubing at base and at each floor.
3. Install hangers for vertical PEX piping every 48 inches (1200 mm).
4. Install PEX tubing in accordance with the Uponor Plumbing Design Assistance Manual or the Uponor Professional Plumbing Installation Guide.

I. Supports for PVC piping:
1. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
a. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
b. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
c. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
d. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
e. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
2. Install supports for vertical PVC piping every 48 inches (1200 mm).
3. Support vertical piping and tubing at base and at each floor.

J. Supports for PP piping:
1. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:
a. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
b. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
c. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
d. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
e. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
f. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod
2. Install supports for vertical PP piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.
3. Support vertical piping and tubing at base and at each floor.
4. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

K. Supports for insulated piping:
1. Attach clamps and spacers to piping.
a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

(Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers)

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees. (Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers)
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

L. Supports for Vertical-Piping
1. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
   b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

M. Design hangers for pipe movement without disengagement of supported pipe.

N. Provide clearance in hangers and from structure and other equipment for installation of insulation.

O. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

3.4 INSTALLATION - SLEEVES

A. Exterior watertight entries, such as grade beam, basement wall, sump wall etc.: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors one (1) inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation or caulk. Firestopping required at all penetrations of rated floor and walls.

F. Install chrome plated steel escutcheons at finished surfaces.

3.5 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating. Refer to Architectural drawings for location of all rated walls and floors.

D. Fire Rated Surface:
   1. Seal opening at floor and wall as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

E. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
      b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
      c. Install type of sealant or caulk suitable for application.
   2. Install escutcheons where pipe, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
   3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

END OF SECTION 22 05 29

SECTION 22 05 48.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

C. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

D. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

E. SECTION 22 20 23 – GAS PIPING

F. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.2 DEFINITIONS

A. IBC: International Building Code.

1.3 PERFORMANCE REQUIREMENTS

A. It is the intent of this specification to provide vibration isolation supports for all equipment, piping and ductwork as may be required to prevent transmission of vibration to the building structure. It will be the Contractor's responsibility to select and install vibration isolators which will enable the noise criteria standards to be met, to the extent that the noise can be controlled by the vibration isolators.

B. All vibration isolation devices, including auxiliary steel bases and pouring forms, shall be designed and furnished by a single manufacturer or supplier.

C. Unless otherwise noted or scheduled, spring type vibration isolators shall be used for all equipment driven by motors of 0.5 HP and larger. Deflections as tabulated are minimums and it shall be the responsibility of the isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance in order to prevent the transmission of objectionable vibrations and meet the noise criteria referenced herein.

D. Unless otherwise noted, equipment driven by motors 0.25 HP and smaller shall be isolated by means of Type ND elastomeric mounts or Type HD elastomeric hangers properly sized for 0.35 inch deflection.

E. All elastomeric isolators shall be of high quality synthetic rubber with anti-ozone and anti-oxidant additives.

F. Design and treat vibration isolators for resistance to corrosion. Furnish phosphatized steel components with epoxy powder paint coating. Components exposed to the weather shall be epoxy powder paint coated or hot-dipped galvanized. Furnish zinc electroplated nuts, bolts and

washers. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

G. Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind loads of 30 lbs/sq.ft. Wind loading shall be applied to all exposed surface of the isolated equipment in order to identify worst case load.

H. All spring isolators shall be completely stable in operation and shall be designed for not less than 50 percent reserve deflection beyond actual operating conditions. All spring isolators must be completely stable in operation and have a Kx/Ky ratio of at least 1:1.

I. All isolation materials and flexible connectors shall be of the same manufacturer and shall be selected and certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor at no additional cost to the Owner. Manufacturer may purchase other manufactured products in order to meet this specification and shall guarantee outsourced product as a single point of responsibility. Outsourced products must be identified as such in the submittal for approval.

J. The contractor and manufacturer of the isolation and equipment shall refer to the isolator schedule which lists isolator types and isolator deflections.

K. Deflection table is based on maintaining rooms at the following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE and ANSI S1.8.
   1. Offices
      a. Executive: 30
      b. Conference rooms: 30
      c. Private: 35
      d. Open-plan areas: 35
      e. Computer/business machine areas: 40
      f. Public circulation: 40

   2. Schools
      a. Lecture and classrooms: 30
      b. Open-plan classrooms: 35

   3. Libraries: 25
   4. Theaters
      a. Theater: 25
      b. Stage house: 25
      c. Trap room: 25
      d. Orchestra pit: 25
      e. Rehearsal rooms: 25
      f. Teaching studios: 30
      g. Practice rooms: 30
      h. Ensemble rooms: 30
      i. Shop: 45

1.4 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, and layout as well as connection details.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating materials and dimensional data. All steel bases and concrete inertia bases shall be completely detailed. Include clearly outlined procedures for installing and adjusting the isolators.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

F. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate vibration isolation installation is complete and in accordance with instructions. Provide a copy of field report to Architect/Engineer.

H. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. All Plumbing systems vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATOR TYPES

A. All vibration isolators described in this section shall be the product of a single manufacturer. . Submittals and certification sheets shall be in accordance with Specification 1.3 of this section.
1. Manufacturers:
   a. Mason Industries
   b. Kinetics Noise Control
   c. Amber / Booth
   d. Vibration Eliminator

B. Type WSW: Two layers of 3/8-inch thick neoprene pad consisting of square waffle modules separated horizontally by a 16-gauge galvanized shim. Where the load bearing area of the equipment is not the same size/shape as the load bearing area/shape of the pad, load distribution plates, minimum ¼” thick galvanized steel, shall be utilized to ensure the load bearing capacity of the pad is maximized. Pads shall be sized for approximate deflection of 0.12 inch to 0.16 inch.

C. Type ND: Neoprene mountings shall have minimum static deflection of 0.35 inch. All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes on

the bottom and a tapped hole with a mounting bolt and washer shall be provided. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang. Where the load bearing area of the equipment or support structure is not the same size/shape as the load bearing area/shape of the pad, load distribution plates, minimum ¼" thick galvanized steel, shall be utilized to ensure the load bearing capacity of the pad is maximized.

D. Type SLF: Spring isolators shall be free-standing and laterally stable without any housing and complete with a steel-washer-reinforced molded neoprene cup of 1/4-inch neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have minimum additional travel to solid equal to 50 percent of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.

E. Type SLR: Restrained spring mountings shall have an SLF mounting as described in Specification 2.1 C, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2 inch shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position under outdoor equipment, there must be an internal isolation pad in addition to the friction pad on bottom.

F. Type HD: Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch thick neoprene element. The neoprene element shall have neoprene bushings projecting through the steel box. In order to maintain stability, the boxes shall not be articulated as clevis hangers.

G. Type 30N: Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch thick neoprene elements at the top and a steel spring as described in 2.1 C, seated in a steel-washer-reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability, the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

H. Type PC30N: Hangers shall be as described in Specification 2.1 F, but they shall be precompressed and locked at the rated deflection by means of a resilient up stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30-degree capability.

I. Type WBI/WBD: Horizontal thrust restraints shall consist of a spring element in series with a neoprene molded cup, as described in paragraph 2.1 C, with the same deflection as specified for the mountings or hangers supporting the unit. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4-inch movement at start and stop. The assembly shall be furnished with a rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit.

J. Type SLR-MT: Restrained air spring mountings shall be manufactured with upper and lower steel sections connected by a replaceable flexible DuPont Kevlar reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. Restrained air springs shall be within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2 inch {12mm} shall be maintained around restraining bolts and between the housing and the air springs so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Air spring systems shall be connected to a supplementary air supply compressor (supplied with the air spring system) through a Mason Industries air spring control panel and equipped with three leveling valves to maintain level within plus or minus 0.125". Air spring mounts are to be located between the supporting steel and the roof or the grillage and dunnage as shown on the drawings when there is no provision for direct mounting. Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician.

2.2 BASES

A. Type WF: A welded integral structural steel fan and motor base with NEMA standard motor slide rails and holes drilled to receive the fan and motor slide rails. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split-case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14 inches provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height-saving brackets shall be employed in all mounting locations to maintain a 1-inch operating clearance under base.

B. Type ICS: Vibration isolation manufacturer shall provide steel members welded to height-saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base. Members shall have sufficient rigidity to prevent misalignment of equipment.

C. Type RBMK. Vibration isolation manufacturer shall furnish structural steel concrete pouring forms for floating concrete bases. Wood formed bases, formed steel bases and sheet metal formed bases are not acceptable. Bases for split-case pumps shall be large enough to provide for suction and discharge elbows. Bases may be T or L shaped where space is a problem. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6 inches. The base depth need not exceed 12 inches unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2-inch bars welded in place on 6-inch centers running both ways in a layer 1-1/2 inches above the bottom. Forms shall be furnished with steel templates to hold the anchor bolt sleeves and anchor bolts while concrete is being poured. Recessed height-saving brackets shall be employed in all mounting locations to maintain a 1-inch operating clearance under base.

2.3 FLEXIBLE PIPE CONNECTIONS

A. Type SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR: Flanged and threaded rubber flexible joints shall be peroxide cured EPDM throughout with Kevlar tire cord reinforcement. Substitutions must have certifiable equal or superior characteristics. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable.

Sizes 1-1/2" through 14"shall have a ductile iron external ring between the two spheres. Sizes 16" through 24" may be single sphere. Sizes 3/4" through 2" may have one sphere, bolted threaded flange assemblies and cable retention. Minimum ratings through 14"shall be 250psi at 170°F and 215psi at 250°F, 16" through 24" 180psi at 170°F and 150psi at 250°F. Higher published rated connectors may be used where required. Safety factors shall be a minimum of 3/1. All flexible joints must be factory tested to 150% of maximum pressure for 12 minutes before shipment. The piping gap shall be equal to the length of the flexible joint under pressure. Control rods passing through 1/2"thick Neoprene washer bushings large enough to take the thrust at 1000psi of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the flexible joint rating without them. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.

2.4 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING ISOLATION

A. Horizontal Pipe Isolation: All pumped water, pumped condensate and refrigerant piping size 1-1/4 inch and larger within mechanical rooms and on pipe size 2 inch and larger outside mechanical rooms shall be isolated. Outside equipment rooms this piping shall be isolated for the greater of 50 feet or 100 pipe diameters from externally isolated equipment. For the first 3 support locations from externally isolated equipment provide Type 30N hangers or Type SLF floor mounts with the same deflection as equipment isolators. All other piping within the equipment rooms shall be isolated with the same specification isolators with a 1” inch minimum deflection. Install piping hangers at regular intervals according the pipe hanger schedule.

Where floor supports are required, provide sufficient spring capacity to absorb expansion and contraction of piping, and yet to permit piping to function as a floating system. Size hangers for 200 percent rated load. Coordinate selection of piping supports with equipment supports to accommodate expansion and contraction without creating excessive stresses at equipment connections.

B. Pipe Riser Isolation: All vertical pipe risers 1-1/4 inch and larger, where specifically shown and detailed on riser drawings shall be fully supported by Type SW SLF isolators with brackets. Refer to details on Drawings. Steel spring deflection shall be 3/4 inch minimum. In locations where added deflection is required due to pipe expansion/contraction, the spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the riser in tension. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Provide Type SWS wall sleeves. In addition to submittal data requirements previously outlined, riser diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the piping system has been examined for excessive stresses and that none will exist in the design proposed.

3.3 INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 33.

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Locate isolation hangers as near the overhead support structure as possible.

D. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

E. Install isolated inertia base frames and steel bases on isolator units as indicated so that a minimum of one (1) inch clearance below base will result when supported equipment has been installed and loaded for operation.

F. Install flexible pipe connectors to equipment supported by vibration isolation. Provide line size flexible connectors.

G. Comply with manufacturer’s instructions for the installation and load application of vibration isolation materials and products. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation or shipment.

H. Install cables so they do not bend across edges of adjacent equipment or building structure.

I. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

J. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

K. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

L. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least **four** of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 22 05 48

SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 22.
B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the owner or owner's representative.

1.3 RELATED WORK

A. Division 1 - GENERAL REQUIREMENTS.
B. Section 01 09 00 - GENERAL COMMISSIONING REQUIREMENTS.
C. Section 01 33 00 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.4 SUMMARY

A. This Section includes requirements for commissioning plumbing systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.
B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.5 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.6 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 22 is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 22, is required in cooperation with the Owner and the Commissioning Agent.
B. The Plumbing systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.7 SUBMITTALS

A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the OWNER prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of the Building Plumbing Systems will require inspection of individual elements of the Plumbing construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning Plan to schedule inspections as required to support the commissioning process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the OWNER and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 22 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF OWNER PERSONNEL

A. Training of the OWNER operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 22 Sections for additional Contractor training requirements.

END OF SECTION 22 08 00

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

C. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

D. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

E. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.3 SUMMARY

A. Provide a complete domestic water piping system.

B. Provide pressure gauge with all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, and leave in safe and proper operating condition all systems.

C. All materials and equipment for the potable water system shall meet the latest mandates and requirements for lead free required by law that goes into effect January 2014.

1.4 SUBMITTALS

A. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Gauge: Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and manufacturer instruction.
4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.7 EXTRA MATERIALS

A. Furnish two (2) packing kits for each size valve and two (2) loose keys for outside hydrants.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. Products and materials listed herein are for references of approved materials.

B. Unless noted otherwise, the contract documents (schedule sheet) will specify the products and materials that are to be used for this project.

2.2 WATER PIPING, BELOW GRADE

A. Copper Tubing: ASTM B88, Type K.
   1. Fittings: ASME B16.22 wrought copper and bronze.
   2. Joints: AWS A5.8, BCuP silver braze.

2.3 WATER PIPING, ABOVE GRADE

A. Copper Tubing 6” and smaller: ASTM B88, Type L hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints:
      a. Solder, lead free, ASTM B32, 95-5TA (tin-antimony), or tin and silver, with melting range 430 to 535 degrees F. [Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.]
      b. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
      c. Appurtenances for Grooved-End Copper Tubing:
         1) Manufacturers: Subject to compliance with requirements, provide products from the following or approved equal:
            a) Victaulic
         2) Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
         3) Mechanical Couplings for Grooved-End Copper Tubing:
            a) Copper-tube dimensions and design similar to AWWA C606.
            b) Ferrous housing sections.
            c) EPDM-rubber gaskets suitable for hot and cold water.
            d) Bolts and nuts.
            e) Minimum Pressure Rating: 300 psig.
   3. At the contractor’s option, Press connection copper fittings manufactured by Viega or approved equal will be acceptable. Building services piping –20 degrees to +250 degrees up to 200 PSI. Fittings shall comply with NSF-61, CSA, UPC. Seals shall be made of EPDM material and manufactured with an inboard bead design. The fittings shall include the Smart Connect feature to identify unpressed connections during system testing. All fittings shall be installed in accordance with the manufacturer’s installation instructions and according to local plumbing and mechanical codes.
      a. Only pproved manufacturer(s):
         1) Viega

2.4 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size two (2) inches and Smaller:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Pipe Size 2-1/2 inches and Larger:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets (Victaulic split ring flange is not allowed).
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
   3. PEX-a tube and pipe: Class 150 ASME B16.5 flanges; ASTM F1960 joints.

2.5 GALVANIC PROTECTION

A. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

B. Dielectric Connections:
   1. Two (2) inches and smaller union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   2. 2-1/2 inches and larger, forged steel flanges, screwed neck, 1/16 inch thick performed neoprene gasket. (Same as paragraph B, above.)

C. Dielectric connections are not to be used. The connection between dissimilar piping materials shall be made with approved brass fittings. Braised, welded, soldered, or screwed – as required by the material being connected.

2.6 VALVES

A. General
   1. Valves shall be located to permit easy operation, replacement and repair. They shall be installed where shown on the Drawings, or as herein specified.
   2. Control valves shall be provided for the domestic hot and cold water supply to all risers and specific areas such as restrooms, fixture groups, shock absorbers, equipment, hose bibbs and wall hydrants, food service areas and building separations. Valves shall be located in back-of-house or service areas with access panels or above lay-in ceilings. No access panels will be permitted in public spaces with gypsum ceilings.

B. Ball Valves:
   1. Manufacturers:
      a. NIBCO.
      b. Milwaukee.
      c. Keystone.
   2. Two (2) inches and Smaller: Nibco S/T-585-66-LF, full-port, MSS SP 110, Class 150, 600 psi CWP, silicon bronze, two piece body, stainless steel ball, teflon seats and stuffing box ring, blow-out proof stainless steel stem, lever handle with balancing stops, solder or threaded ends. No Lead.
   3. Where piping is insulated, ball valves shall be equipped with two (2) inch extended handles of non-thermal conductive CPVC material that meets UL 2043 approved for inside air plenum. Also provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.

Memory stops, which are fully adjustable after insulation is applied, shall be included.

4. Ball valves installed outdoors or in-ground shall have stainless steel handle.
5. Ball Valves for PEX-a Two (2) inches and smaller: NSF 359, Class 150, 250 psi CWP, forged brass, two piece body, brass ball, Teflon (PTFE) seats, blow-out proof stem, lever handle, ASTM F1960 ends. No Lead. Basis of design Uponor Lead-free Commercial Ball Valves.
6. Provide stem extensions of a non-thermal conducting material for valves in insulated lines to allow unobstructed operation.
7. Provide memory stops on all ball valves installed in domestic hot water return lines. Memory stops shall be adjustable after pipe insulation is applied.

C. Shut-off Valves:
1. Manufacturers:
   a. NIBCO.
   b. Milwaukee.
   c. Keystone
2. Line Shut-Off Valves 2-1/2” to 3” where system operating pressure will not exceed 300 p.s.i.g. shall be 300 WOG LEAD-FREE ductile iron body with non-rising stem, ductile iron wheel handle, bronze stem and flange ends. Acceptable valves are Nibco F-619-RWS.
3. Line Shut-Off Valves 4” and larger where system operating pressure will not exceed 300 p.s.i.g. shall be 300 CWP ductile iron body gate valve with non rising stem, resilient wedge, flange ends, EPDM liner and seal. Acceptable valves are NIBCO Model F-619-RWS/SON.
4. Provide stem extensions of a non-thermal conducting material for valves in insulated lines to allow unobstructed operation.

D. Swing Check Valves:
1. Manufacturers:
   a. NIBCO.
   b. Watts
2. Two (2) inches and Smaller: Nibco S-413-LF Series, class 125, MSS SP 80, silicon bronze body, stainless steel and PTFE disc, and soldered ends. No Lead.
3. 2-1/2 inches and Larger: NIBCO INC. F918-SS Series, MSS SP 71, cast iron body, stainless steel fitted, stainless steel disc, flanged ends. No Lead.

E. Balancing Valves (Hot Water Recirculation)
1. Balancing valves shall be venturi orifice type, bronze or brass body with brass or chrome ball, a minimum of two differential pressure read-out ports, 300 psi maximum working pressure. A compatible positive shutoff ball valve with memory stop is to be provided if not included with the balancing valve assembly.
2. Balancing valves shall be “Circ Setter” by Bell and Gossett.
3. Ball valves are not acceptable for balancing the hot water return system.

2.7 STRAINERS

A. Manufacturer: NIBCO, Mueller Steam Specialty.

B. Two (2) inches and Smaller: Threaded bronze body for 200 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen. NIBCO INC., 221 Series.

C. 2-1/2 and Larger: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen. NIBCO INC., F-721 Series.

D. Lead Free.

2.8 GAGES AND TAPS

A. Manufacturers: For portable water system (Lead Free)
1. Weiss
2. Marsh Bellofram
3. Weksler
4. Dwyer

B. Gage: ASME B40.1, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Stainless steel.
2. Bourdon Tube: Phosphor bronze.
3. Dial Size: 4-1/2 diameter.
4. Mid-Scale Accuracy: One (1) percent.
5. Scale: Psi.

C. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.

D. Ball Valve: Brass 1/4 inch NPT for 250 psi.

E. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

F. Siphon: Brass, 1/4 inch NPT angle or straight pattern.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than two (2) feet of cover.

C. Establish minimum separation from other services piping in accordance with code.

D. Remove scale and dirt on inside of piping before assembly.

E. Install pipe on prepared bedding.

F. Route pipe in straight line.

G. Install pipe to allow for expansion and contraction without stressing pipe or joints.

H. Do not use lead bearing solder materials.

I. Pipe Cover and Backfilling:
1. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in four (4) inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
2. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
3. Do not use wheeled or tracked vehicles for tamping.

J. Provide tracer wire for all piping routed below slab locate wire leads in accessible location for use in future line trouble shooting.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Insulate all piping installed in exterior walls, above food service areas, and any area exposed to temperatures below 40 degrees Fahrenheit.

B. Install non-conducting dielectric connections wherever jointing dissimilar metals.

C. Insulate all domestic hot water supply and return lines.

D. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

G. Provide expansion tank for each domestic water heater, install per manufacturer's recommendations.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 05 29.

I. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Architect.

J. Establish elevations of buried piping outside the building to obtain not less than one (1) foot of cover.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Install water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors.

N. Install unions downstream of valves and at equipment or apparatus connections.

O. Install valves with stems upright or horizontal, not inverted.

P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

Q. Install ball valves for shut-off and to isolate equipment at branch to each fixture bank and at each plumbing appliance or water heater.

R. Provide check valves on discharge of all water circulating pumps.

S. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

T. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

U. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to all equipment with solenoid valves.

V. Route all domestic water piping inside building in climate controlled space not subject to freezing.

W. Do not use lead bearing solder materials.

X. In natatorium, including equipment rooms, all exposed plumbing piping shall be insulated and protected by a complete aluminum jacketing system. Refer to Section 23 07 16 for specification on jacketing. Provide color coded, printed pipe label 10’ on center identifying pipe service type (gas, domestic water, storm water, etc.).

Y. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas. Size plates to fit pipe or insulation and lock in place.

Z. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following.

AA. Press-Connect Joints for Copper Tubing: Join copper tube and press-connect fittings with tools recommended by fitting manufacturer.

BB. Pipe Joint Construction: PEX-a Connections: Install per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for ASTM F 1960 connections.

CC. Lead Free.

3.5 INSTALLATION - SERVICE CONNECTIONS

A. At each incoming water service line provide approved reduced pressure back-flow preventer. Coordinate with division 23 to install gas flow meter provided by division 23 and install by this contractor.

B. Provide a cast iron sleeve around service main to six (6) inches above floor and six (6) inches minimum below grade beam. Size for minimum of two (2) inches of loose batt insulation stuffing.

C. Optionally, where building structural components permit, water service entrance may be composed of a single extended 90 degree fitting of fabricated 304 stainless steel tubing, maximum Working pressure of 175 psi with grooved-end connection on the outlet (building) side and a cast iron pipe size coupler on the underground (inlet) side.

3.6 INSTALLATION - BACKFLOW PREVENTERS

A. Provide at each make up connection to a hot water boiler, cooling tower, chilled water system, kitchen equipment, and at each piece of equipment requiring a make-up connection.

B. Provide at water supply to fire protection system.

C. Provide a floor drain within six (6) feet of each backflow preventer.

D. Backflow preventer shall be certified by Contractor.

E. Lead Free.

3.7 INSTALLATION – PRESSURE GAGES

A. Install pressure gages for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.

B. Install gage taps in piping with isolation valves.

C. Install pressure gages at main water entry. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install gage in piping to each inlet and outlet of water heater.

E. Install gage in piping to each end of backflow preventer.

F. Install gage in piping to each end of double check valves.

G. Install gage in piping to each inlet and outlet of water softener.

H. Install gage in piping to each inlet of water filter.

I. Install gage in piping to each inlet of commercial dishwasher machine.

3.8 DOMESTIC HOT WATER SYSTEM BALANCING

A. The test and balance contractor shall provide testing, adjusting and balancing of the hot water system, once the system is fully installed and operational. Preliminary and final reports shall be prepared and issued to the General Contractor, Architect and Engineer.

B. Preparation of the hot water system for balancing:

1. Confirm outlet temperature of the system at water heaters and/or storage tanks.
2. Verify recirculation pump operation and rotation.
3. Confirm/adjust setpoint of each individual riser balancing valve to flow a minimum of 0.5 gpm or as otherwise noted on the documents.

C. The test and balance report shall indicate the following:

1. Pressure, temperature and flow in gpm at the discharge side of each balancing valve referencing the valve tag number.
2. Pressure, temperature and flow in gpm at the suction side of each recirculating pump.

D. Copies of the final approved balancing report are to be included in the O and M manuals as noted in “Permits” under Part 1 of Section 22 05 00.

3.9 FIELD QUALITY CONTROL

A. Pressure test all domestic water piping.

B. After installation and prior to backfill or cover-up, rinse piping system of particulate contaminants, cap and subject to static water pressure of 125 psig for four (4) hours.

C. Repair leaks and defects and re-test any portion of piping system that fails.

D. Provide written test report including date and time of test, pass or fail indication, summary of remedial work required and date and time of each re-test.

E. Installers for PEX-a piping shall have completed the applicable training courses per manufacturer’s requirements.

F. Cleaning of piping systems:
1. General cleaning of piping systems: Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge, and circulate.
2. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only.
3. Phase One: Initial flushing of system.
   a. Remove loose dirt, mill scale, weld beads, rust and other deleterious substance without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until “potable water clear” and particles larger than 5 microns are removed.
   b. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
4. Phase Two: Cleaning of Piping Systems:
   a. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide), and other deleterious substances not removed by initial flushing.
   b. Flush system and replace with clean water.
5. Phase Three: Final flushing and rinsing:
   a. Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
6. Submit status reports upon completion of each phase of work on each system.

G. Branch Connections:
1. Pipe 2” and smaller. For threaded piping, use straight size reducing tee. When branch is small than header, a nipple and reducing coupling or swagged nipple may be used.

H. 2-1/2” through 36”. For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

I. See section 220500 for additional requirements.

END OF SECTION 22 11 16

SECTION 22 11 23 - DOMESTIC WATER PRESSURE BOOSTER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

C. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

D. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

E. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

F. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.2 SUMMARY

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all mechanical systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.

1.3 STANDARDS

A. The domestic water pressure booster system shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides:

1. The International Plumbing Code, 2018 Edition, with most current State of Texas Amendments
2. The International Building Code, 2018 Edition, with most current State of Texas Amendments
3. UL Listing - All motors, controllers and electrical components shall carry a UL Approval for the assembly.
4. NEMA Compliance - All controllers shall be designed in accordance with the

specified NEMA requirements.

5. ANSI/NSF 61 compliance is required for all components of the domestic water system.
6. ASHRAE 90.1, 201 Section 10.4
7. NSF61-G / NSF372

1.4 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.5 EQUIPMENT, MATERIAL BID BASIS

A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in the Specifications or on the Drawings as "base" products. Proposed alternate equipment and materials may be submitted along with the "base" products, provided deductive pricing is included with the alternate.

C. Alternate "approved equal" items listed shall conform to specified base items and shall be substantially equal in quality, size, weight, construction and capacities. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. The Engineer shall consider the use of the alternate equipment based on the supportive documentation and other information available to him, and shall approve or disapprove any alternates. The decision of the Engineer shall in all cases be final.

D. The Contractor shall coordinate the installation of all equipment proposed for use in this project with all building trades (architectural, structural, and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.6 SUBMITTALS

A. Shop drawings shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any deviations from specified equipment shall be clearly indicated on the submittal.

B. Included with shop drawings of mechanical equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the mechanical and electrical contractors. A photocopied reproduction of the below statement is acceptable.

C. Submittal shall include pump curves with selection point clearly identified and wiring diagrams for all electrical components.

D. See additional requirements in section 22 05 00.

1.7 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.

B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of three (3) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

1.8 QUALITY ASSURANCE

A. The Domestic water Booster system manufacturer shall have an extensive background and experience in the design and fabrication of Domestic Booster systems.

B. The manufacturer shall have fabricated Domestic water Booster systems for a minimum of ten (10) years.

C. The manufacturer shall provide single source responsibility for complete package. The entire package shall be third party certified by:

1. Underwriters Laboratories Inc.
2. The International Association of Plumbing and Mechanical Officials
3. NSF 372 for compliance to Low Lead Content law

D. Installer's Qualifications: The system shall be installed by a firm having minimum three years experience regularly engaged in the installation of variable speed domestic booster pump systems.

E. Certification shall obtained by the manufacturer indicating that the function and performance characteristics of all products and materials have been determined by testing and ongoing surveillance by an approved third-party certification agency. Assertion of certification shall be in the form of identification in accordance with the requirements of the third-party certification agency

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to the Project Site under provisions of Division 01 and Division 20.

B. Protect internals from entry of foreign material by temporary caps on flanged openings.

C. Store pumps in a dry location. Retain shipping flange, protective covers and protective coatings during storage. Protect bearings and couplings against damage from sand, grit and other foreign matter. Comply with manufacturers' rigging instructions for handling.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pressure ratings of pumps, pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed.

B. The Contractor shall ascertain for himself the space and access available for the installation of a factory assembled packaged unit and as an option may assemble the various components in place at the Site in lieu of providing a factory assembled unit. However, all components of the system shall be compatible and be furnished by a single source manufacturer and all electrical services and interconnecting equipment wiring must be provided for within this Contractors bid.

C. The booster system shall be factory assembled on a steel skid including pumps, motors, valves, Type "L" copper or Schedule 40 300 series stainless steel suction and discharge manifolds, all interconnecting piping, wiring, variable frequency drives with logic and power controls.

D. Over pressurization of the system while operating across-the-line shall be prevented by a pilot operated diaphragm type combination pressure regulating and non-slam check valve on each pump. Main valve and cover shall be ductile iron with a fused epoxy coating and stainless steel stem and cover bolts. Construction shall be suitable for the maximum working pressure of the system.

E. All pilot lights and visual indicators shall be illuminated from the rear by long life LED lamps. Neon and incandescent lamps are not acceptable.

F. Provide isolation valves on the suction and discharge of each pump. The isolation valves shall be 600 WOG full-port ball valves (2" and smaller) and lug style butterfly valves (2½ “ and larger).

G. Provide two 4 1/2" ASME grade A, panel mounted gauges for indicating system suction and system discharge pressure.

H. All skid-mounted components shall be factory finished in high quality epoxy or enamel paint. The base shall be suitable for grouting.

I. The packaged pumping system shall include all electrical wiring between components and shall be completed and tested at the factory prior to shipment.

J. Unions or flanges shall be provided for easy removal of pumps. Pipe headers shall be sized for a velocity not exceeding 7-1/2 FPS and shall be terminated with a groove joint capable of accepting a groove coupling or groove flange furnished by Contractor.

K. System shall be arranged such that single point connections are required for piping and electrical power supply.

L. Individual pumps, motors and pressure regulating or check valves shall be serviceable with the booster system in operation.

M. All similar components shall be of one manufacturer, (i.e., valves, gauges, etc.).

N. Refer to schedules on Contract Drawings for required pump capacities and electrical characteristics.

2.2 DOMESTIC WATER PRESSURE BOOSTER SYSTEM

A. Furnish and install a factory fabricated vertical or horizontal mounted triplex pressure booster system. The system shall be capable of the capacity and flow rate as indicated on the Drawings, refer to sheet P-501.

B. Pumps and Motor

1. Pumps shall be variable speed horizontal or vertical multi-stage equipped with stainless steel shaft and impeller and sleeve mounted mechanical shaft seal.
2. Each close-coupled pump motor shall be TEFC and of the energy efficient type and shall meet NEMA standards and operate within the available service factor at any point on the pump capacity head curve.
3. Motors shall be high efficiency and balanced to a maximum vibration amplitude of .001". Motors shall have ball bearings and operate at 40° ambient. Each motor shall be equipped with the manufacturer's nameplate and shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor. The motor shall have a service factor of 1.15 for variations in voltage and frequency.
4. Each pump shall be provided with an individual temperature probe and purge valve having adjustable high temperature set point and differential to sense heat buildup in the pump casing. On sensing high temperature the probe circuit shall open a solenoid valve that allows the heated water to flow out.
5. All pumps shall be provided with VFD drives.

C. Variable Frequency Drives

1. Provide and mount on the system skid variable frequency drives of the PWM design suitable for variable torque applications using any standard NEMA Design B squirrel cage induction motor. Variable frequency drives shall sized for the maximum possible amp draw throughout the programmed sequence of pump operation.

2. The efficiency at full load and full speed shall be 97% with a fundamental power factor of .98.

3. Drives shall be pulse width modulated, start into a rotating load, follow signal from logic section of control panel when in auto mode and be provided with the following features:

   a. Hand/off/auto switch and manual speed adjustment.
   b. Auto Drive Shutdown for electrical fault.
   c. Automatic restart after power fails shutdown.
   d. Provide complete service diagnostics with fault history log.

4. Keypad Operator Device including the following:

   a. 2 Line Backlit LCD Display.
   b. Power On and Alarm/Fault Displays.

5. Operational data displays include:

    a. Drive Speed (HZ)
    b. Motor Power
    c. Energy (kWh)
    d. Current
    e. Elapsed Time
    f. RPM
    g. Motor Voltage

D. Pump Sequencing

1. The pump designated as the lead pump shall start following a 5 second On-Delay time after sensing a drop in the system pressure 5 PSI below the desired set point value
2. The pump controller shall compare a signal from the discharge pressure transducer to the set point value and the lead pump speed shall ramp up in order to satisfy the set point pressure.
3. The lag pump shall start following a 60 second On-Delay time, when the lead pump exceeds its best operating point (BOP), and a minimum run timer shall ensure that the lag pump runs for a minimum of 60 seconds.
4. The lag pump shall ramp down in speed and turn off when the pumps that are running are operating at a point below the BOP and the lag pump minimum run timer has expired.
5. The lead pump shall continue to operate and meet system requirements based on the set point value.
6. The lead pump shall alternate every 24 hrs of operation where the second pump shall start and run for a period of 5 seconds, both pumps shall operate, the first pump on shall ramp down and the new lead pump shall continue to operate as above to meet system requirements

E. Lead pump shutdown controls

1. All systems are equipped with a 'No-Flow' shutdown that will stop the pumps when the pump controller determines there has been a 'No-Flow' condition for a continuous 5 minute period.
2. The lead pump will start again once a drop in pressure of at least 5 psi is measured on the discharge of the system.
3. The system can be manually operated by means of the virtual Hand-off-Auto (HOA) selector buttons provided on the operator interface

F. Factory Fabrication

1. The system shall be factory fabricated complete with isolation valves on the suction and discharge of each pump. Suction and discharge manifolds are to be Type L copper or schedule 40 stainless steel. The pump assembly shall be provided with anti-vibration pads as specified below. The only field connections required will be to system headers, tank (if required), over temperature drain tube, and one incoming power connection at the control panel.
2. Provide stainless steel double sphere floating flange flexible vibration isolator complete with stainless steel control rod assemblies on the suction and discharge headers; Kinetics Kinflex FTC series or Engineer approved equal.
3. Provide base mount free-standing unhoused spring vibration isolators with 1/4" minimum neoprene noise isolation pads, Kinetics FDS series or Engineer approved

equal.

4. Provide 6" minimum thickness inertia base frame for the mounting of the booster pump, Kinetics series CIB-L or Engineer approved equal.

G. Factory Test and Certification

1. The booster system and its component parts shall undergo a complete operating flow test from zero to 100% design flow rate under the specified suction and net system pressure conditions. The system shall carry an ETL certification of testing.

H. Start-Up-Service

1. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and start-up of the booster pump assembly. A formal report is to be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the operator's personnel shall be provided following certification of the assembly.

I. Acceptable manufacturers in compliance with the specified requirements:

1. Grundfos with CougarUSA
2. Armstrong with Texas AirSystems
3. Aurora

2.3 POWER AND CONTROL PANEL

A. Assembly shall include a NEMA 12 power and control panel complete with three through the door disconnect switches, circuit breakers, magnetic starters each with 3 leg overload protection, fused control circuit transformer, automatic 24-hour alternation, low suction shutdown with visual alarm light and auxiliary contact, pump indicating lights, multiple position selector switches, control power light, low system indicating light, and lag pump start time delays. All of the above shall be factory internally pre-wired and tested in accordance with provisions of the National Electric Code. All control wires shall be individually numbered and each component shall be labeled accordingly. All internal wiring shall be copper stranded, A.W.G. with a minimum insulation of 90 degrees C. The complete assembly shall have the UL listing mark for industrial control panels.

B. Instrumentation and Emergency Controls:

1. Each system shall have panel mounted pressure gauges for indicating suction and system discharge pressure. A pre-wired and pre-piped temperature probe shall be installed in each pump and connected to a common electric purge valve for over temperature protection of pumps alarm horn with silence circuit, high system alarm with time delay, high suction shutdown with time delay, low level alarm light.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide pumps to operate at specified system fluid temperatures and scheduled capacities. Pumps shall operate without vapor binding and cavitations, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories. Provide no less than the minimum as required by the manufacturer.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping

D. Equipment Mounting: Install base-mounted pumps on cast-in-place concrete equipment bases.

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct bases to withstand, without damage to equipment, seismic force required by code.

3. Construct concrete bases 4 high and extend base not less than 6 inches in all directions beyond the maximum dimensions of base-mounted pumps unless otherwise indicated or unless required for seismic-anchor support.

4. Install base mounted pumps on concrete inertia base “RBMK” with spring isolators. Refer to section 22 05 00.

E. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled, split coupled vertical in-line or base mounted pumps; install supports under elbows on pump suction and discharge line sizes four (4) inches and over.

F. Provide air cock and drain connection on horizontal pump casings.

G. Provide drains for bases and seals. Route to floor drain.

H. Lubricate pumps before start-up according to manufacturer’s instructions.

3.3 ALIGNMENT

A. Alignment Service shall be performed by a factory authorized direct service technician. Alignment work shall not be performed by installing mechanical contractor.

B. Comply with pump and coupling manufacturers' written instructions.

3.4 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to pump, allow space for service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install triple-duty valve on discharge side of pumps.

F. Install suction diffuser with stainless steel strainer and shutoff valve on suction side of pumps.

G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves. Exception: do not install flexible connectors at or near split coupled vertical in-line pumps.

H. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

3.5 STARTUP SERVICE

A. Start up service shall be performed by a factory authorized direct service technician. Start up work shall not be performed by installing mechanical contractor.

1. Complete installation and startup checks according to manufacturer's written instructions.

    a. Check piping connections for tightness.

    b. Clean strainers on suction piping.

    c. Perform the following startup checks for each pump before starting:

        1) Verify bearing lubrication.

        2) Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

        3) Verify that pump is rotating in the correct direction.

    d. Prime pump by opening suction valves and closing drains, and prepare pump for operation.

e. Start motor.

f. Open discharge valve slowly.

3.6 DEMONSTRATION

A. Demonstration shall be performed by a factory authorized direct service technician. Demonstration shall not be performed by installing mechanical contractor.

1. Train owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

2. Provide documentation of owner training in close out submittal. See additional requirements in section 22 05 00.

END OF SECTION 22 11 23

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

C. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

D. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

E. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.3 SUMMARY

A. Provide a complete sanitary drainage system.

1.4 SUBMITTALS

A. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.
   2. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

B. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include spare parts lists, exploded assembly views for pumps and equipment.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the plumbing code.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. Products and materials listed herein are for references of approved materials.

B. Unless noted otherwise, the contract documents (schedule sheet) will specify the products and materials that are to be used for this project.

2.2 SANITARY SEWER PIPING, BELOW GRADE

A. Manufacturers
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe/Soil Division

B. PVC Pipe
   1. Provide a complete system of solid wall schedule 40 PVC DWV piping with solvent welded joints.
   2. Solvent welded joints shall conform to IAPMP installation standards IS-9.
   3. Pipe and fittings shall conform to ASTM D 1784, AST D 1785, ASTM D 2665, ASTM D 3311, and NPS standard 14 & 61.

C. CPVC Pipe (Grease Waste Applications)
   1. Provide a complete system of solid wall schedule 40 CPVC DWV piping with solvent welded joints.
   2. Solvent welded joints shall conform to IAPMO installation standards.
   3. Provide tracer wire at all under slab piping and wire terminate at building exit. Wire to be 12AWG, green insulation, and copper conductor. Provide cast junction box flush with finished grade permanently labeled “Tracer Wire”. Extend wire from exit point around all non-metallic piping to properly line, coordinate installation with Civil contractor.
   4. Pipe and fittings basis of design shall be Charlotte ChemDrain® Chlorinated Polyvinyl Chloride (CPVC-cwd) schedule 40, non-pressure DWV type conforming to ASTM F2618.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Manufacturers
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe/Soil Division

B. Cast Iron Pipe: ASTM A888 and CISPI 301, hub-less, service weight and marked with the collective trademark of the CISPI and listed by NSF International.
   1. Fittings: No hub cast iron fittings per CISPI 301 and ASTM A888.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies conforming to ASTM C564. Heavy duty couplings are required on no-hub systems at the base of stack and vertical to horizontal offsets and shall conform to the requirements of ASTM C1540 and shall be type 304 stainless steel

shielded couplings with stainless steel worm gear clamps, 15 psi working pressure.
a. Acceptable Manufacturers: Ideal Tridon, Clamp-All High Torq 125 or Husky SD-4000.
3. Transition coupling: No hub cast iron pipe to PVC use Husky SD-4200.

2.4 VENT PIPING, ABOVE GRADE

A. Manufacturers
1. AB&I
2. Charlotte Pipe and Foundry Co.
3. Tyler Pipe/Soil Division

B. Cast Iron Pipe: ASTM A888 and CISPI 301, hub-less, service weight and marked with the collective trademark of the CISPI and listed by NSF International.
1. Fittings: No hub cast iron fittings per CISPI 301 and ASTM A888.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies conforming to ASTM C564. Heavy duty couplings are required on no-hub systems at the base of stack and vertical to horizontal offsets and shall conform to the requirements of ASTM C1540 and shall be type 304 stainless steel shielded couplings with stainless steel worm gear clamps, 15 psi working pressure.
a. Acceptable Manufacturers: Ideal Tridon, Tyler Wide Body or Husky HD-2000.

2.5 VENT PIPING, BELOW GRADE

A. Use same as Sanitary Sewer Piping, Below Grade.

PART 3 - EXECUTION

3.1 FLOOR DRAINS

A. Provide floor drain, including sanitary waste and vent piping, where indicated on drawings and at each toilet room containing two (2) or more water closets or a combination of one (1) water closet and one (1) urinal.

B. Coordinate the exact location of all floor drains with Architectural Drawings prior to rough-in. Ensure drains are located at low points(s) of floor slope.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Coordinate the exact location of all floor drains with architectural drawings prior to rough-in. Ensure drains are located at low point(s) of floor slope.

C. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert as indicated on Drawings.

B. Establish minimum separation from other services piping in accordance with code.

C. Remove scale and dirt on inside of piping before assembly.

D. Install with a uniform slope of not less than 1/4 of an inch per foot.

E. Install pipe on prepared bedding of bank sand, minimum of 2” depth on bottom of trench up to centerline of pipe.

F. Route pipe in straight line.

G. Excavation:
1. Excavate trenches for underground piping to the required depth to ensure two (2) foot minimum coverage over piping.
2. Cut the bottom of the trench or excavation to uniform grade.
3. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

H. Pipe Cover and Backfilling:
1. Backfill shall not be placed until the work has been inspected, tested, and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.
2. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in eight (8) inch maximum layers, loose measure. Compact to not less than 95% of maximum soil density as determined by ASTM D-698 Standard Proctor.
3. PVC-piping shall be installed per the requirements of ASTM D 2321, which details the trench width per pipe size, bedding depth, backfill and compaction, as well as other factors. Calculating maximum burial depths for flexible piping requires the use of external loading software, additional information and free software is available at www.uni-bell.org.
4. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.

I. Disposal of excess material:
1. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by Owner/Architect.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot (one (1) percent) minimum. Maintain gradients.

B. Provide and installed cleanout as required by code and local AHJ.

C. Furnish and install cleanouts in soil and waste lines as required by Code and/or job conditions, as shown on the Drawings and as follows: At or near the end of each branch and main drainage line, horizontal lines at intervals as required by code. All cleanouts shall be readily accessible, with plugs easily removable for cleanout lines. Cleanouts at the base of vertical piping shall be held within 2'-0" from finished floor unless otherwise indicated.

D. Install a floor clean out according to the following;
1. Not more than 40’ apart in all horizontal drain lines.
2. At each change of direction greater than 45 Deg.
3. At the base of each waste or soil stack.
4. Install floor cleanouts at elevation to accommodate finished floor.
5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
6. Provide Wye cleanouts with long sweeps turned up to elevated floor conditions for cleanout openings at floor drain waist lines.

E. Install a wall cleanout according to the following:
1. Install a wall cleanout at every sanitary piping within wet wall chase for all urinals. Wall cleanout shall be flush with exterior side of wall
2. Provide full size wall cleanouts at end of run and on soil stack at ganged toilets were pipes penetrate the slab including water closets, lavatories and EDF’s.
3.

F. Install a exterior cleanout according to the following:
1. Encase exterior cleanouts in concrete flush with grade.
2. Provide double cleanouts where building sanitary sewer system and civil sewage system intersect.
3.

G. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

H. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

I. Install piping to maintain headroom. Do not spread piping, conserve space.

J. Group piping whenever practical at common elevations.

K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation.

M. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Architect.

N. Install piping penetrating roofed areas to maintain integrity of roof assembly.

O. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

P. Burred ends of all pipe and tubing shall be reamed to the bore of the pipe or tube and all chips shall be removed before installation.

Q. Install bell and spigot pipe with bell end upstream.

R. Sleeve pipes passing through partitions, walls and floors.

S. Support cast iron drainage piping at every joint.

T. Water test all piping per code.

U. Insulate all above slab horizontal sanitary waste piping carrying air-conditioning condensate with fiberglass insulation with jacket from floor drain, including traps, all the way to change in direction to vertical.

V. Slope all vent piping to allow for drainage.

W. Provide and install a floor sink next to each HVAC air handling unit, pump, expansion tank, and every piece of HVAC equipment requiring condensate removal in every mechanical room.

X. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations.

Y. PVC-piping is a combustible material per ASTM E 136 and shall not be installed in return air plenums unless it is fire wrapped to meet all the requirements of ASTM E 84 test protocol with a flame spread index of 25 and a developed smoke spread of 50 or less.

3.5 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completions of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned. Rodding operations shall be witnessed by Owner's field representative. Submit a certificate of completion to owner.

3.6 FIELD QUALITY CONTROL

A. Separate trenches for water lines, sanitary, storm, and gas piping.

B. Piping shall be labeled along entire length; indicating size, class, material specification, manufacturers name, and country of origin.

C. Piping and fittings resting on ground is unacceptable. Keep products covered. Provide temporary end caps and closures on piping and fittings.

D. Foreign pipe and fittings unacceptable.

E. Prior to cover up water pipe, sanitary pipe, and gas piping shall be pressure tested. Tests shall be witnessed by consultant and owner. Notify owner 48 hours prior to test. Test shall be witnessed by client plumbing technician.

F. The inside of all sanitary lines shall be video recorded with a camera and witnessed by owner to first outside manhole. Provide tape and/or DVD upon closeout of project. If any obstructions are found they shall be removed and the line shall be videoed again to show the blockage has been cleared.

G. For additions and renovations, use camera to locate routing of underslab lines.

H. Upon completion of the sanitary piping system, the contractor shall notify engineer and owner to observe a smoke test of the system. Smoke testing shall be performed on sanitary piping system twice during construction.

END OF SECTION 22 13 16

SECTION 22 14 13 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

C. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

D. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

E. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.2 SUMMARY

A. Provide a complete storm drainage piping system.

B. Section Includes:
1. Storm Piping Below Grade

2. Storm (Including Overflow) Piping Above Grade

1.3 SUBMITTALS

A. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories.

2. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

B. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Products and materials listed herein are for references of approved materials.

B. Unless noted otherwise, the contract documents (schedule sheet) will specify the products and materials that are to be used for this project.

2.2 STORM WATER PIPING, BELOW GRADE

A. PVC Pipe
1. Provide a complete system of solid wall schedule 40 PVC DWV piping with solvent welded joints.

2. Provide tracer wire at all underslab piping and wire terminate at building exit. Wire to be 12AWG, green insulation, and copper conductor. Provide cast junction box flush with finished grade permanently labeled “Tracer Wire”. Extend wire from exit point around all non-metallic piping to properly line, coordinate installation with Civil contractor.

B. Contractor Option: Provide a complete system of schedule 40 PVC with solvent welded joints.

C. Foam core PVC piping is not acceptable for any drainage system.

2.3 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A888 and CISPI 301, hub-less, service weight and marked with the collective trademark of the CISPI and listed by NSF International.
1. Fittings: No hub cast iron fittings per CISPI 301 and ASTM A888.

2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies conforming to ASTM C564. Heavy duty couplings are required on no-hub systems at the base of stack and vertical to horizontal offsets and shall conform to the requirements of ASTM C1540 and shall be type 304 stainless steel shielded couplings with stainless steel worm gear clamps, 15 psi working pressure.
a. Acceptable Manufacturers: Ideal Tridon or Husky HD-4000.
3. Transition coupling: No hub cast iron pipe to PVC use Husky SD 4200 transition coupling.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than two (2) feet of cover.

C. Establish minimum separation from other services piping in accordance with code.

D. Remove scale and dirt on inside of piping before assembly.

E. Install pipe with uniform slope of not less than 1/8 of an inch per foot.

F. Install pipe on prepared bedding of bank sand, minimum of 2” depth on bottom of trench up to centerline of pipe.

G. Route pipe in straight line.

H. Pipe Cover and Backfilling:
1. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in four (4) inches compacted layers to 12 inches minimum cover over top of pipe.

2. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.

3. Do not use wheeled or tracked vehicles for tamping.

I. Provide tracer wire for all piping routed below slab locate wire leads in accessible location for use in future line trouble shooting.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage 1/8 inch per foot (one (1) percent) minimum. Maintain gradients.

B. Provide and installed cleanout as required by code and local AHJ.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearance at cleanout for snaking drainage system.

D. Furnish and install cleanouts in soil and waste lines as required by Code and/or job conditions, as shown on the Drawings and as follows: At or near the end of each branch and main drainage line, horizontal lines at intervals as required by code. All cleanouts shall be readily accessible, with plugs easily removable for cleanout lines. Cleanouts at the base of vertical piping shall be held within 2'-0" from finished floor unless otherwise indicated.

E. Install a floor clean out according to the following;
1. Not more than 40’ apart in all horizontal drain lines.
2. Install floor cleanouts at elevation to accommodate finished floor.
3. At each change of direction greater than 45 Deg.
4. At the base of each waste or soil stack.
5. Install floor cleanouts at elevation to accommodate finished floor.
6. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

F. Install a wall cleanout according to the following:
1. Install a wall cleanout at every sanitary piping within wet wall chase for all urinals. Wall cleanout shall be flush with exterior side of wall.

G. Install a exterior cleanout according to the following:
1. Encase exterior cleanouts in concrete flush with grade.

2. Provide double cleanouts where building sanitary sewer system and civil sewage system intersect per code.

H. Provide Wye cleanouts with long sweeps turned up to elevated floor conditions for cleanout openings at floor drain waist lines

I. Install non-conducting dielectric connections wherever jointing dissimilar metals.

J. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

K. Install piping to maintain headroom. Group piping to conserve space.

L. Group piping whenever practical at common elevations.

M. Support cast iron drainage piping at every joint.

N. Provide bracing at horizontal pipe and fittings larger than 4 inches in size. Pipe and fittings shall be suitably braced to prevent horizontal movement at every branch opening or change of direction by use of braces, blocks, rodding, or other suitable method as required to prevent movement or joint separation.

O. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

P. Provide clearance in hangers and from structure and other equipment for installation of insulation.

Q. Install piping penetrating roofed areas to maintain integrity of roof assembly.

R. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

S. Install bell and spigot pipe with bell end upstream.

T. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.

U. Provide heavy-duty clamps, fittings and gaskets at no-hub connections to all roof and overflow drains then transition to bell and spigot piping system.

V. PVC-piping is a combustible material per ASTM E 136 and shall not be installed in return air plenums unless it is fire wrapped to meet all the requirements of ASTM E 84 test protocol with a flame spread index of 25 and a developed smoke spread of 50 or less.

W. Insulate all horizontal storm and overflow drain piping with fiberglass insulation with service jacket. For exposed locations provide rigid insulation with rigid jacket. Insulate from roof drain body, past first elbow all the way to change to vertical direction, including y-fittings.

3.4 RODDING SEWERS

A. All storm lines, both in the building and out, shall be rodded out after completion of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned. Rodding operations shall be witnessed by Owner's field representative. Submit a certificate of completion to owner.

END OF SECTION 22 14 13

SECTION 22 20 23 - GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

C. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

D. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

E. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.2 SUMMARY

A. Provide a complete natural gas piping system to all gas-burning appliances and all natural connectors.

B. This section covers the complete first class natural gas system installation, within and to five (5) feet beyond building perimeter unless noted otherwise on Contract Drawings, including but not limited to piping, regulators, unions, valves, installation, testing and other normal parts that make the systems complete, operable, code compliant and acceptable to the authorities having jurisdiction.

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. 2015 Edition of the International Fuel Gas Code.

   2. Latest Edition of NFPA 54, National Fuel Gas Code.

   3. Minimum Safety Standards for Natural Gas, 49 Code of Federal Regulations (CFR) Part 192, as Required by Title 16 of the Texas Administration Code § 8.70.

1.4 SUBMITTALS

A. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.

   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

3. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
   a. Strainers.
   b. Natural gas pressure regulators.
   c. Natural gas pressure relief valves.
   d. Tape form pipe coating.

B. Test Reports: Indicate results of piping system pressure test.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves, piping system, and system components.

B. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

1.6 QUALITY ASSURANCE

A. All materials, equipment and Work shall meet or exceed all applicable federal, state and local requirements and conform to codes and ordinances of authorities having jurisdiction.

B. Valves: Manufacturer’s name, size, standards compliance and pressure rating clearly marked on outside of valve body.

C. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

E. Installer Qualifications: Company specializing in performing the Work of this Section with minimum three (3) years documented experience. Installation of natural gas systems shall be performed by individuals licensed by the Texas State Board of Plumbing Examiners as a Journeyman or Master Plumber. All installation shall be supervised by a licensed Master Plumber. All testing shall be performed by a licensed Journeyman or Master Plumber. Welders shall be certified in accordance with ASME Section 9.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.9 EXTRA MATERIALS

A. Furnish two packing kits for each type and size valve.

PART 2 - PRODUCTS

2.2 MANUFACTURERS

A. Products and materials listed herein are for references of approved materials.

B. Unless noted otherwise, the contract documents (schedule sheet) will specify the products and materials that are to be used for this project.

2.3 NATURAL GAS PIPING, BELOW GRADE

A. Provide Underground Gas Polyethylene (PE), SDR-11, ASTM D2513 pipe and fittings with heat fusion socket joints.
   1. Polyethylene pipe and fitting materials shall be compatible and by same manufacturer to ensure uniform melting and a proper bond. Fabricated fittings shall not be used.

   2. Provide connection between buried plastic gas service piping and metallic riser in accordance with the gas code. Provide metallic riser consisting of HDPE fused coating on steel pipe for connection to above ground building distribution piping. Underground horizontal metallic portion of riser shall be at least twenty four inches in length before connecting to the plastic service pipe. An approved transition fitting or adaptor meeting design pressure rating and plastic pipe manufacturers recommendations shall be used where the plastic joins the metallic riser.

2.4 NATURAL GAS PIPING, ABOVE GRADE (OUTDOOR)

A. Piping 1½ inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with Class 150 black malleable iron threaded fittings conforming to ASME B16.3.

B. Piping 2 inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.

C. Provide factory-applied, three-layer coating of epoxy, adhesive, and PE or field applied primer and epoxy paint coating on all pipe and fittings. Field applied coating is restricted to fittings and short sections of pipe necessarily stripped for threading or welding. Field coating shall be manufactured by Amercoat Type 240 or approved equal and applied in accordance with manufacturer's recommendations. Galvanizing shall not be considered adequate protection.

2.5 NATURAL GAS PIPING, ABOVE GRADE (INDOOR)

A. Steel Pipe: ASTM A53 Schedule 40 black.
   1. Fittings: ASTM A234/A234M forged steel welding type.

2. Joints: NFPA 54, Welded to ASME B31.9.

3. NOTE:
   a. All exposed piping 1½ inches and smaller located within areas utilized as return air plenums shall have welded joints with Schedule 40 socket welded forged steel fittings conforming to ASME B16.11.
   b. All exposed piping 1½ inches and smaller serving laboratories from main natural gas riser to each emergency shut-off valve shall have welded joints with Schedule 40 socket welded forged steel fittings conforming to ASME B16.11.

2.6 UNIONS AND COUPLINGS

A. Ferrous pipe: 150 psi malleable iron threaded connections.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.7 VALVES

A. Manufacturers:
   1. NIBCO.
   2. Milwaukee.
   3. Keystone

B. Ball Valves:
   1. 1/4 inch to 2-1/2 inch, MSS SP 110, 250 psi, two piece, threaded ends, bronze body, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port. Nibco T-585-70-UL.

   2. 3 to 4 inch, MSS SP 110, 250 psi, two piece, threaded ends, brass body, stainless steel ball, reinforced teflon seats, blow-out proof stem, lever handle, UL listed for flammable liquids and LPG, Full port. Nibco T-FP-600A (CSA, UL, FM).

   3. 3 inch and larger, MSS-SP-78, Type IV, Class 125, ASME/ANSI B16.38, 200 psi, lubricated plug valves with flanged or threaded ends. Bodies, plugs and bonnets shall be made from Gray Iron castings, ASTM A-126, Class B. Homestead Valve series 600 (CSA, UL, FM).

2.8 STRAINERS

A. Manufacturers:
   1. O.C. Keckley Company or approved equal.

B. Two (2) inch and Smaller: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. 2-1/2 inch to four (4) inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. Five (5) inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.9 NATURAL GAS PRESSURE REGULATORS

A. Manufacturers:
   1. Rockwell Meter Co.

B. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.
   1. Temperatures: minus 20 degrees Fahrenheit to 150 degrees Fahrenheit.
   2. Body: Steel.
   3. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.
   4. Disk, diaphragm, and O-ring: Nitrile.
   5. Maximum inlet pressure: 150 psig
   6. Furnish sizes two (2) inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.

2.10 NATURAL GAS PRESSURE RELIEF VALVES

A. Manufacturers:
   1. Rockwell Meter Co.

B. Product Description: Spring loaded type relief valve.
   1. Body: Aluminum.
   2. Diaphragm: Nitrile.
   3. Orifice: Brass.
   4. Maximum operating temperature: 150 degrees Fahrenheit.
   5. Inlet Connections: Threaded.
   6. Outlet or Vent Connection: Same size as inlet connection.

2.11 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum six (6) inches wide by four (4) mil thick, manufactured for direct burial service.

2.12 PROTECTIVE COATING

A. Underground steel service entry piping shall be furnished with factory applied plastic coating and field coating at joints conforming to AWWA Standard C-203. All valves, fittings, and joints in underground piping shall be field coated using a heat-applied coal tar enamel tape, using two coats of heavy mastic, using “Scotchwrap,” “CT Tapecoat” or “X-Tru-Tape.” Field coating shall extend over mill wrapping a minimum of 4 inches. Damaged coating shall be repaired as specified for valves, fittings, and joints.

2.13 EMERGENCY SHUT-OFF VALVE

A. Kitchen.
   1. The main gas supply to kitchen equipment shall be provided with an automatic solenoid valve with manual reset lever. The valve shall be interconnected with

the hood fire suppression system to shut down gas supply to all kitchen equipment.

2. The valve shall be energized to open, closed when de-energized with manual reset. The required voltage shall be coordinated with the electrical contractor. The valve shall carry a UL Listing.
3. The emergency shutoff valve is to be provided with manual shutoff valves and unions on each side and located in a surface mount steel cabinet with flush solid metal door. The cabinet is to be located as shown on the drawings with the top of cabinet flush with finished ceiling. The cabinet shall be Potter Roemer 1000 series or approved equal.
4. The emergency shutoff valve is to be provided with manual shutoff valves and unions on each side and located in a surface mount steel cabinet with flush solid metal door. The cabinet is to be located as shown on the drawings with the top of cabinet flush with finished ceiling. The cabinet shall be Potter Roemer 1000 series or approved equal.
5. Valves 3/4"-2-1/2" in size shall be ASCO 8044 series.

B. Laboratory Classrooms – See related section 22 30 00 and 22 51 00.

PART 3 - EXECUTION

3.2 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Install plastic ribbon tape continuous over top of pipe buried six (6) inches below finish grade, above pipe line.

3.4 INSTALLATION - BURIED PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Establish minimum separation of gas pipe from other services, piping in accordance with code.

C. Install continuous jacket or tape.

D. Install gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure regulators. Gas service distribution piping to have initial minimum pressure of 5 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

E. Install Work in accordance with Gas Company standards.

F. Pressure test natural gas piping in accordance with NFPA 54. Pressure test prior to backfill, minimum 50 psi for 24 hours.

G. Provide pipe sleeve as required for gas pipe routing under slab or in conceal space.

H. Provide tracer wire for all piping routed below slab locate wire leads in accessible location for use in future line trouble shooting.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide rigid appliance connections for each gas-burning appliance in accordance with code.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Provide an accessible, approved shut-off valve within three (3) feet of each gas appliance. Install such that appliance can be maintained and removed without removal of the shutoff valve.

E. Install gas pressure regulator vent full size opening on regulator and terminate outdoors.

F. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 5 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

G. Install service pipe and set gas meters in accordance with Gas Company regulations. Coordinate with division 23 to install gas flow meter provided by division 23 and install by this contractor.

H. Gas piping installed in plenums and chases shall be welded.

I. Provide shut-off valves on both sides of all gas regulators for isolation of gas regulators.

J. Provide a manual shut off valve on the appliance gas supply line in addition to the Kitchen Ansul unit automatic shut off.

K. Provide a gas valve manifold to isolate kitchen gas appliances individually at one location.

L. Provide separate gas valves on each fixture in labs.

M. Provide a gas isolation valve on the lab controller unit.

N. Install a test port of each side of all natural gas pressure regulators.

O. Perform a pressure test of all replaced natural gas piping.

P. Gas piping on roof shall be supported at appropriate intervals to prevent sagging. Spacing shall be determined by the roof type and loading. No piping shall rest directly on the roof.

Q. All supports shall be manufactured for the purpose of supporting pipe. Wood blocks are not an acceptable means of pipe support.

3.6 FIELD QUALITY CONTROL

A. Pressure test natural gas piping in accordance with NFPA 54. Pressure test prior to backfill, minimum 50 psi for 24 hours.

B. Defective joints or piping shall be replaced as required and the system shall then be re-tested.

END OF SECTION 22 20 23

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

C. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

D. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

E. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.2 SUMMARY

A. Provide a complete installation for each equipment type listed in this section.

B. Section Includes:
1. COMMERCIAL NATURAL GAS DOMESTIC WATER HEATER
2. COMMERCIAL ELECTRIC WATER HEATERS
3. VACUUM RELIEF VALVES
4. IN-LINE CIRCULATORS
5. T & P RELIEF VALVES
6. DIAPHRAGM-TYPE EXPANSION TANKS
7. GARBAGE DISPOSAL
8. GREASE TRAP (Gravity)
9. WATER SOFTENERS (WS-1)
10. SURGE TANK (COMBINED FIRE AND DOMESTIC – WITH PARTITION)
11. ART ROOM SINK PLASTER TRAP
12. ACID DILUTION TRAP
13. SAMPLING WELL
14. BACKFLOW PREVENTERS
15. WATER PRESSURE REGULATING VALVES
16. WATER HAMMER ARRESTORS
17. THERMOSTATIC MIXING VALVES
18. SOLENOID VALVES
19. TEMPERATURE INSTRUMENTS

1.3 SUBMITTALS

A. Product Data: Submit complete manufacturer's specification pages for each piece of equipment. Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity and power requirements. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Submit electrical characteristics and connection locations.

B. Manufacturer's Installation Instructions: Submit mounting and support requirements.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept all equipment on site in original labeled cartons. Inspect for damage.

B. Protect heat exchangers and tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.5 EXTRA MATERIALS

A. Furnish two pump seals.

PART 2 - PRODUCTS

2.1 COMMERCIAL NATURAL GAS DOMESTIC WATER HEATER (Min 95% EFF)

A. Manufacturers:
1. AO Smith,
2. Lochinvar
3. Ruud

B. Furnish and install condensing, low NOx, modulating natural gas-fired domestic water heaters with a minimum thermal efficiency of 95% when tested to ANSI Z21.10.3 with the standby loss, and all other requirements of latest edition of ASHRAE 90.1b. The unit shall be NSF 61 standard tested and compliant for drinking water use. The dimensions, capacities, natural gas requirements and electrical characteristics of the water heater shall be as scheduled on the Contract Drawings and as outlined herein. This Specification describes minimum quality and performance requirements. Variations of system components by the individual referenced manufacturers are acceptable for installation in this project provided they meet or exceed all of the requirements scheduled on Contract Drawings, indicated herein and fit properly in the space provided.

C. Gas water heater(s) shall be equipped with a powered gas burner with electronic flame safeguard, intermittent electronic ignition, main and pilot automatic gas valves, redundant solenoid gas valve, gas pressure regulator, diaphragm switch for proof of boiler operation, and flame inspection port. Maximum gas supple pressure to heater(s) shall be 13” W.C., and ASME working pressure shall be 160 psi. Water heater(s) shall have the followings:
1. Modulating gas burner that automatically adjusts the input based on demand.
2. Powered anodes that are non-sacrificial and maintenance free.
3. Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded.
4. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up
5. Be approved for 0″ clearance to combustibles.

D. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout and other components shall include manual-reset high-temperature limit control, upper and lower thermostats, combination temperature and pressure gauge,

low-water cutoff, ASME-rated temperature and pressure relief valve, drain valve and draft regulator. Control compartment door shall be hinged for easy access.

1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 standards governing storage type water heaters.
2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

E. The heater(s) shall meet or exceed current standard or ASHRAE/IESNA 90.1 for recovery efficiency and standby loss. The tank shall have a 5-year warranty against failure as outlined in the written warranty. Professional start-up service shall be included.

F. The tank shall be glass lined with alkaline borosilicate composition and fused to the steel by firing at 1600°F and shall be insulated with fiberglass insulation. The heater will also be equipped with multiple anodes for cathodic protection. Heater(s) shall be equipped with 1-1/2" NPT water inlet and outlet openings, and two 3" handhole cleanouts. The heater(s) shall be constructed on accordance with ASME code, and the entire unit listed by Underwriters Laboratories.

G. Water heater(s) shall capable for remote monitoring, leak detection and fault alert. Provide dry contacts for shut down command from CO monitor.

H. Capacities: GHW-X (X = as scheduled); Water storage as scheduled; Located in hot water boiler room, gallon per hour recovery at 100-degree rise.

1. Accessories:
   a. Provide regulator for 5 lb. gas service pressure.
   b. Provide single point power connection as scheduled.
   c. Provide neutralization drain kit as required.
   d. Provide Concentric vent kit as required.
   e. Provide integral heat traps.
   f. Provide drain pan.

2. 120K-250K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for power venting using a 4" diameter pipe for a total distance of (120 ft.) equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a 4″-diameter pipe for a total distance of (120 ft.) equivalent feet of vent piping and (120 ft.) equivalent feet of intake air piping.
3. 300K - 500K BTU Input: For Standard Power Venting: Water heater(s) shall be suitable for standard power venting using a (6″) diameter pipe for a total distance of (120 ft.) equivalent feet of vent piping. For Power Direct Venting: Water heater(s) shall be suitable for power direct venting using a (6″) diameter pipe for a total distance of (120 ft.) equivalent feet of vent piping and (120 ft.) equivalent feet of intake air piping.

2.5 COMMERCIAL ELECTRIC WATER HEATERS (EWH-x)

A. Manufacturers:

1. A.O. Smith.
2. Rheem.
3. State
4. All electric point-of-use storage tank type water heaters provided within this project shall be the product of one manufacturer.

B. Furnish and install a Factory-assembled and wired, electric, vertical storage domestic hot water heaters with dimensions, capacities and electrical characteristics as scheduled on the Contract Drawings and as outlined herein. This Specification describes minimum quality and performance requirements. Variations of system components by the individual referenced manufacturers are acceptable for installation in this project provided they meet or exceed all of the requirements indicated herein, are compatible with the electrical service provided and fit properly in the allocated space.

C. Water heater(s) shall have the UL seal of certification and be factory equipped with an ASME rated temperature and pressure relief valve. Water heater(s) shall be constructed in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section IV Part HLW. Tank(s) shall have a coating of high temperature porcelain enamel and furnished with two (2) magnesium anode rods rigidly supported. Water heater(s) shall meet or exceed the standby loss requirements of ASHRAE. Tank(s) shall have a working pressure of 160 psi and shall be completely assembled.

D. Tank: Shall be insulated with 2-1/2" of rigid polyurethane foam insulation or with minimum two (2) inches glass fiber polyurethane encased in corrosion-resistant steel jacket; baked-on enamel finish.

E. Controls: Equip with diagnostic panel utilizing light emitting diodes. Each LED will correspond to the number and location of the heating elements and monitor their on-off function. Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees Fahrenheit, flanged or screw-in nichrome elements, high temperature limit thermostat. Water heater(s) shall be provided with internal power circuit fusing, control circuit fusing, magnetic contactors, 120-volt control circuit transformer and immersion thermostat(s) with manual reset high limit control.

F. Water heater(s) shall capable for remote monitoring, Controls, leak detection and fault alert.

G. The heater(s) shall meet or exceed current standard or ASHRAE/IESNA 90.1 for recovery efficiency and standby loss. The tank shall have a 5-year warranty against failure as outlined in the written warranty. Professional start-up service shall be included.

H. Capacity:
1. Storage capacity: as indicated.
2. Heating element size: as indicated.
3. Number of heating elements: as indicated.
4. Minimum recovery rate: (as indicated) gph with 100 degrees Fahrenheit temperature rise.
5. Maximum working pressure: 160 psig.
6. Provide integral heat traps.
7. Provide drain pan.

I. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

2.7 VACUUM RELIEF VALVES

A. Construction shall be bronze body with silicone disc having a dry guide which is located out of the water. Unit shall open at less than 1/2" vacuum and be suitable for use within a system having a maximum water pressure of 200 psi and a maximum temperature of 250°F. Vacuum relief valves shall be in compliance with the appropriate requirements of ANSI Z21.22.

B. Vacuum relief valves shall be manufactured by Watts Regulator, Wilkins or Conbraco.

2.8 IN-LINE CIRCULATORS

A. Manufacturers:
1. Bell and Gossett
2. Taco
3. Aurora
4. Armstrong
5. Grundfos

B. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 80 psig, 150 psig maximum working pressure.

C. Casing: Cast iron, with flanged pump connections.

D. Impeller: Cast bronze, dynamically balanced and keyed on shaft.

E. Bearings: Two, oil lubricated bronze sleeve, integral thrust collar.

F. Seal: Carbon rotating against stationary ceramic seat, 212 degrees Fahrenheit maximum continuous operating temperature.

G. Drive: Flexible coupling.

H. As scheduled and fitted with remote heat sensing aqua-stat and timer.

I. Aqua-stat: Honeywell – Model L4006A1009 (100 – 240 degree range) or approved equal by Johnson Controls and Dayton.

J. Timer: Armstrong – Model 810233-130 or approved equal by Taco, Bell and Gossett, Grundfos, or Intermatic

2.9 T & P RELIEF VALVES

A. Manufacturers: Watts Industries or approved equal.

B. Temperature and Pressure Relief:
1. ANSI Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees Fahrenheit, capacity ASME Section IV certified and labeled.

C. Vacuum Relief Valves:
1. Watts N36 Lead Free Series.

2.10 DIAPHRAGM-TYPE EXPANSION TANKS

A. Manufacturers: Bell & Gosset PT Series or approved equal.

B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

D. Provide separate support to structure for expansion tank

2.11 GARBAGE DISPOSAL

A. Insinkerator Model 444, 120V, 3/4 HP, provide all trim and accessories for City approved installation.

2.13 GREASE TRAP

A. Manufacturer:
   1. ParkUSA

B. Concrete gravity grease interceptor.

C. Manhole frames, covers or grates are manufactured of grey cast iron conforming to ASTM A48-76 Class 30. Manhole shall be nominal 24-inch diameter and be traffic duty and gas-tight access covers.

D. Provide an approved sampling well connection.

2.17 WATER SOFTENERS (WS-1)

A. Provide water softening equipment to remove hardness (calcium carbonate) to the extent that the effluent from the water softener, under operating conditions, shall contain zero grains per gallon of hardness as determined by an accepted titration hardness test method.

B. Guarantee:
   1. That the loss of ion exchange resin through attrition during the first three (3) years of operation shall not exceed three (3) percent per year.
   2. That the resin shall not be washed out of the system during the service run of backwashing period.
   3. That the turbidity and color of the effluent, by reason of passing through the softener system, shall not be greater that the incoming water.

C. Tank:
   1. Design tanks for working pressure of 100 psi.
   2. Tanks shall be fiberglass reinforced polyester.

D. Brine System:
   1. Provide a combination salt storage and brine measuring tank with cover.
      a. Large enough to hold salt for at least four generations at full salting.
      b. Tank shall be constructed of molded white polyethylene with cover.
   2. Equip the brine tank with:
      a. A float operated, plastic fitted, field serviceable brine valve for automatic control of brine withdrawal and freshwater refill.
      b. The brine valve shall provide positive shut-off to prevent air from entering the system.

E. Softener Tanks:
   1. Shall consist of 2 two modules as shown on drawings.

F. System Manufacturer Star-Up Service:
   1. Provide the services of factory trained service technicians to start up the system.
      a. Technicians shall be trained and experienced on the work they conduct.

2. Monitor the operation of the softener.
3. Follow the manufacturer's start up procedures.
   a. Provide appropriate programming of the electronic programmable control.
4. During the test and start up procedure, concurrently instruct the owner's operating personnel.

G. Instructions:
1. Provide a complete set of instructions covering the installation, operation and servicing of the water softener and programming of the controls.
2. Insert in the Owner's manual.

H. Water Testing Equipment:
1. Provide a sample cock installed for obtaining samples of the effluent water.
2. Provide a complete water testing kit for conducting a hardness test.

I. Capacity:
1. The water softening equipment shall have the capacity of following 60 GPM with a pressure loss not to exceed 15 PSI for each unit. Provide unit with a minimum capacity of 150,000 grains and 5 cubic feet of resin.

J. Installation:
1. All piping shall be type "L" copper.

2. Arrange piping for easy dismantling to permit cleaning and service.
3. Install the system in accordance with the manufacturers "installation, start-up and service instructions".

K. Submittals:
1. Submit shop drawings and product data as specified.
2. Submit manufacturer's certified capacity data.
3. Submit manufacturer's "installation, start-up and service" instructions.

L. Acceptable Manufacturers:
1. Unity
2. Watertech
3. Marlo

2.18 SURGE TANK (COMBINED FIRE AND DOMESTIC – WITH PARTITION):

A. General: Provide and install a new welded steel surge tank at the location shown on the Drawings and mount on a 6” concrete housekeeping pad. Size shall be as indicated on Drawings. Provide, construct, install and test tank in strict accordance with the following codes and standards:

1. NFPA Pamphlet No. 22-1984, Standard for Water Tanks for Private Fire Protection.

2. Latest Edition of AWWA Standard D100, Standard for Welded Steel Tanks for Water Storage.

3. American Welding Society specifications for vessel fabrication.

4. Local AHJ latest adopted code with all local amendments.

B. All material used in tank construction shall be new and unused. The tank manufacturer shall have a minimum of five years' experience in building 3500 gallon or larger tanks for use in commercial applications. The tank manufacturer shall provide:

1. A written and notarized certificate, signed by the owner or an officer of the tank manufacturing company, stating that the tank has been constructed and tested in strict accordance with these specifications and all requirements of the codes and standards listed above.

C. Construction:

1. Tank fittings and accessories shall include the following and such other items as required for a complete, code compliant system and as indicated on the contact drawings. Pipe connection sizes shall be as indicated on Contract Drawings.

a. Top – ¼" steel plate minimum, ASTM A36.

b. Sides and Bottom – ¼" steel plate minimum, ASTM A36

c. Steel channels stiffeners welded to the top, and sides where required.

d. 24" x 24" manway with gasketed cover in top of tank.

e. 24" x 24" manway with bolted and gasketed cover in sidewall.

f. Stainless steel ladders inside tank and a stainless-steel ladder on outside of tank are to be provided by the tank manufacturer. Dielectric washers must be used when connecting any dissimilar metals to prevent galvanic corrosion.

g. 150 psi ANSI flanges and 3000 psi forged steel half couplings.

h. Water level gauge consisting of two (2) ½" angle valves with ball checks, ¼" needle drain valve, and 5/8" rigid plastic site glass in each tank or compartment. Rigid plastic sight glass to be run inside continuous Unistrut to provide physical protection.

i. Metal nameplate affixed to tank giving the name of fabricator, date of fabrication and serial number of tank.

j. Pump suction with 4' x 4' anti-vortex plate in accordance with NFPA-20, 2-9.10 vortex plate.

k. Pump test return inlet with stilling well.

l. Tank drain outlet.

2. Divide tank with a double wall partition extending to the top of the tank, each wall sealed with a continuous weld between the wall and four sides of the tank. Each wall of the partition shall be minimum 1/4" steel plate. Supports in the partition (between the walls) shall be as follows:

a. Tanks up to and including 8'-0" in height: Minimum 5.4 lb. per foot 4" vertical channels at maximum 2'-0" centers.

b. Tanks higher than 8'-0" in height: Minimum 8.2 lb. per foot 6" vertical channels at maximum 2'-0" on centers.

3. Supports in the walls shall be as follows:

a. Tanks up to and including 8'-0" in height: Minimum 5.4 lb. per foot 4" vertical channels at maximum 2'-0" centers.

b. Tanks higher than 8'-0" in height: Minimum 8.2 lb. per foot 6" vertical channels at maximum 2'-0" on centers.

D. There shall be an air space between the walls of the partition of not less than four (4) inches with an opening (not threaded) at the bottom of and at each end of the partition to give visual evidence of loss of integrity of the walls of the partition. The air space between the partition walls shall be given a one PSI air test with all welds soaped to assure no leaks in the partition chamber. The tank fabricator shall furnish a certificate of compliance with this test.

E. Outside of the tank shall be thoroughly cleaned following fabrication of the tank, using a caustic wash process followed immediately by air drying.

1. Exterior Coating:

a. Sides of Tank: to prevent oxidation, the exterior of the tank must be immediately primed, following cleaning, Apply AMERCOAT 185H Universal Primer with a 1-3 mils dry film thickness to sides of tank.

b. Bottom of Tank: to prevent oxidation, the exterior of the tank must be immediately primed following cleaning. Apply AMERICOAT 78HB Amine -cured coal-tar epoxy (1) coat minimum to be 16 mils dry film thickness.

c. Topcoat for Tanks Located indoors

(1) Following dry time of primer, apply AMERILOCK 600 tank coating with a 5 to 10 mil dry film thickness

(2) Allow to fully Cure based on ambient air temperature chart.

(3) Reapply topcoat no greater than 12 months from the first initial coat.

d. Topcoat for tanks located outdoors:

(1) Following dry time of primer, apply PITTHANE ULTRA 95-812 Series tank coating with a 2-3 mil dry film thickness.

(2) Allow to fully cure based on an ambient air temperature chart.

e. Factory Inspection:

(1) The manufacturers' quality system shall conform to ISO 9001.

(2) Tank exterior coating shall be inspected for mil thickness (Mikrotest or equal).

F. Interior surfaces shall be thoroughly cleaned following fabrication of the tank, using a caustic wash process followed immediately by air drying. Following cleaning and air

drying the interior surfaces must be prepped by sandblasting the interior of the tank to a near white blast as per SSPCSP 10 with a 3 to 5 mil anchor profile. The surface anchor pattern shall be no less than 3.0 mil.

1. Coating:

   a. No shaping, bending, punching, flanging, or grinding may be done on the steel after sand blasting and before coating. Field coating, except for touch-up, will not be permitted.

   b. Coatings shall be in accordance with AWWA D103, Section 12.6 and interior coatings shall be NSF standard 61 approved. Interior coating shall be POLYEURO 5502-18PW Pure Polyurea applied to 90-100 mills average fill thickness (DFT) by a Pure Polyurea certified trained applicator.

2. Factory Inspection: The manufacturer's quality system shall conform to ISO 9001. Interior liner shall be inspected for mil thickness (Mikrotest or equal).

3. Warranty: POLYEURO 5502-18PW PURE Polyurea warranty for the tank lining system is (7) years utilizing the preventive maintenance program of inspections of the application in year 3 and 5 following the application. The warranty letter shall be submitted to the owner upon completion.

G. The tank roof shall be thoroughly cleared following fabrication of the tank, using a caustic wash process followed immediately by air drying. Following cleaning and air drying the entire tank roof + (6) inches down the sides must be sand blasted to achieve a near white blast per SSPCSP 10 with 3-5 mil anchor profile. The surface shall be no less than 3.0 mil.

1. Coating:

   a. No shaping, bending, punching, flanging, or grinding may be done on the steel after blasting and before coating. Field coating, except for touch-up will not be permitted.

   b. Coating shall be in accordance with AWWA D103, Section 12.6 and tank roof liner shall be NSF standard 61 approved. Roof coating shall be PLYEURO 5502-18PW Pure Polyurea applied to 90-100 mils average film thickness (DFT) by a Pure Polyurea certified trained applicator.

2. Factory Inspection: The manufacturer's quality system shall conform to ISO 9001. Interior liner shall be inspected for mil thickness (Mikrotest or equal).

3. Warranty: POLYEURO 5502-18PW PURE Polyurea warranty for the tank lining system is (7) years utilizing the preventive maintenance program of inspections of the application in year 3 and 5 following the application. The warranty letter shall be submitted to the owner upon completion

H. Controls:

1. Water Control Valves (Fill Valve): Clayton No. 124, 125 PSI, hydraulically operated, diaphragm activated, globe float valve. Valves shall be equipped with pilot control and float mechanism on body, closing speed control, and shut off control to close valve if diaphragm is damaged. Float control assembly shall be brass with stainless steel and monel working parts. Float and float rods shall be

brass, stainless steel, or copper, length and size as required. Install floats in Schedule 40 PVC sleeves in tank.

2. Block Valves: CLA-VAL No. 136G-03AB, normally open, self-contained solenoid valve with opening and closing speed control and stainless-steel trim shall be provided as sized on the plans. The valves to be activated by the high-level signal from the respective tank or tank compartment. Where the tank discharge from the overflow is outside the building block valve shall not be required.

3. Water Level Controls: Provide a complete Warrick control system to monitor various conditions in the fire water and domestic water section of the tank. All components of the system shall be U.L. listed. System shall include but not be limited to:

   a. A wall mounted NEMA II U.L. listed control panel. Panel shall house separate controls and devices, unless otherwise indicated, for the fire water and domestic water system. The panel shall include a high- and low-level red light for the fire water system and a high- and low-level red light for the domestic water system. One common 6" alarm bell and service button shall be provided. Provide auxiliary high and low water alarm contacts for each water system.

   b. An electrode fitting with electrodes in each section of the tank. Provide the number of electrodes required to provide the functions specified. Provide a grounding electrode in each section of tank. Grounding electrode shall not be connected to any part of the coated interior of the tank. All electrodes shall be installed in a Schedule 40 PVC sleeve (if required by alarm provider), shall be self-supporting, and shall be capable of being removed from the top of the tank in the space available.

4. The system shall function as follows:

   a. Fire Water System: Provide high and low water alarm and light at panel with followings.

      (1) High Level Alarm

         (a) Alarm buzzer will sound.

         (b) General alarm beacon will be illuminated.

         (c) Fire Tank Red High Level Alarm light will be illuminated.

         (d) Water control valve closure.

         (e) Remote high-level alarm contact closure.

         (f) The alarm buzzer can be silenced by momentarily depressing the silencing pushbutton, however, the general alarm beacon and high- level alarm light will remain illuminated. In addition, the remote alarm contact will remain closed and the water control valve terminal will remain closed until the level in the fire tank has receded below the HIGH-LEVEL ALARM ELCTRODE.

      (2) Low Level Alarm

(a) Alarm buzzer will sound.

(b) General alarm beacon will be illuminated.

(c) Fire Tank Red Low-Level Alarm light will be illuminated.

(d) Remote low-level alarm contact closure.

(e) The alarm buzzer can be silenced by momentarily depressing the silencing pushbutton; however, the general alarm beacon and high low alarm light will remain illuminated. In addition, the remote alarm contact will remain closed until the level in the fire tank has receded below the LOW-LEVEL ALARM ELCTRODE.

b. Domestic Water System: Provide high and low water alarm and light at panel with followings (coordinate with pump manufacturer).

(1) High Level Alarm

(a) Alarm buzzer will sound.

(b) General alarm beacon will be illuminated.

(c) Domestic High-Level Alarm light will be illuminated.

(d) Water control valve closure.

(e) Remote high-level alarm contact closure.

(f) The alarm buzzer can be silenced by momentarily depressing the silencing pushbutton; however, the general alarm beacon and high-level alarm light will remain illuminated. In addition, the remote alarm contact will remain closed and the water control valve terminal will remain closed until the level in the fire tank has receded below the HIGH-LEVEL ALARM ELCTRODE.

(2) Low Level Alarm

(a) Alarm buzzer will sound.

(b) General alarm beacon will be illuminated.

(c) Domestic Low-Level Alarm light will be illuminated.

(d) Normally open pump cut-off contact will close.

(e) Normally Closed pump cut-off contact will open

(f) Remote low-level alarm contact closure.

(g) The alarm buzzer can be silenced by momentarily depressing the silencing pushbutton; however, the general alarm beacon and high low alarm light will

remain illuminated. In addition, the pump cut-off contacts will remain closed/opened and the low-level remote alarm contact will remain closed until the level in the fire tank has risen above the LOW-LEVEL ALARM ELCTRODE.

5. The control wiring between the level alarm control panel and all system devices (level sensors, fill valves, block valves, etc.) is to be the responsibility of the level alarm control system provider with the followings.

   a. Wiring used in the tank to suspend the electrodes should be Warrick 3Z1A.

   b. All wiring shall be in accordance with the national electrical code.

I. Provide engraved lamacoid plate at each red light on panel lettered "Fire Water: High Water Alarm and Low Water Alarm" and "Domestic Water: High Water Alarm and Low Water Alarm" as appropriate.

J. Acceptable Manufacturers:

1. Total Tanks by Delta T Equipment

2. Unitank by Mike Schuller and Associates Inc

3. Park Equipment

2.20 ART ROOM SINK PLASTER TRAP

A. Manufacturer: Watts SI-742 Series, or equal by Josam.

B. Construction: Fabricated Steel Body and Cast-Iron Cover with Galvanized Sub-Coat with White Duco Finish Inside and Outside and Stainless-Steel Perforated Bucket.

C. Coordinate installation with Architectural casework installer, allow adequate room for bucket removal.

2.25 ACID DILUTION TRAP

A. Manufacturer: Striem, Zurn, Spears, Orion.

B. Capacity: 2 gallons

C. Construction:

1. Tanks can be manufactured from polypropylene resin conforming to ASTMD-4101. These tanks can be used at temperatures up to 212°F in continuous service and in areas of high chemical concentration. Polypropylene tanks are translucent.
2. Tank lids can be bolted or welded. Maintenance access ports can be polypropylene threaded plugs or bolted manways. All fittings and penetrations are polypropylene and are located according to the specification.
3. Engineering Data: Neutralization tank to be structurally and hydraulically engineered conforming to Uniform Plumbing Code.

D. At ADA sinks, coordinate install with ADA compatible trap or locate tank in adjacent millwork capable of accommodating the acid dilution trap component.

E. Fill: Chemical rock of 1” to 3” diameter with calcium carbonate equivalent in excess of 85%.

2.26 SAMPLING WELL

A. Manufacturer: Manufacturer: ParkUSA.

B. Construction:
1. Concrete sampling well.
2. Cover shall provide water/gas-tight seal and have minimum 16,000 lbs. load capacity.
3. Provide field cut risers as required to extend covers to grade

2.27 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventers
1. Comply with ASSE 1013.
2. Bronze body, with bronze internal parts and stainless-steel springs.
3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
4. Manufacturers:
   a. Wilkins 975.
   b. Watts Series LF909, or approved equal

B. Double Check Valve Assemblies:
1. Comply with ASSE 1012.
2. Bronze body with corrosion resistant internal parts and stainless-steel springs; two independently operating check valves with intermediate atmospheric vent.
3. Dual Check Valve with Atmospheric Vent shall be installed at referenced cross-connections. Valve shall feature stainless steel and rubber internals protected by an integral strainer. Primary check shall be rubber to rubber seated, backed by the secondary check with rubber to metal seating.
4. Manufacturers:
   a. Wilkins 760.
   b. Watts Series 9D or approved equal.

C. Dual Check Valves:
1. Comply with ANSI/NSF Standard 18, Manual Food and Beverage Dispensing Equipment. (ASSE 1022 Approved Dual Check Valve).
2. Body and adapters are of 316 stainless steel construction and all rubber components comply with FDA food additive regulations.
3. All materials in contact with the potable water are in compliance with the requirements of the Safe Drinking Water Act, Public Law 93-523, National Interim Primary Drinking Water Regulations.
4. Manufacturers:
   a. Wilkins 740.
   b. Watts Model SD-2/9BD, or approved equal

D. Lead Free

2.28 WATER PRESSURE REGULATING VALVES

A. Low to Moderate Flow Systems (Less Than 70 GPM) and Individual Equipment
   1. Sizes 1/2" through 2"
   2. All bronze body
   3. 0.25% maximum weighted average lead content
   4. Integral stainless-steel strainer screen
   5. Built-in bypass check valve
   6. FDA approved elastomers
   7. Renewable seat
   8. Union end connection
   9. Rated for water temperature up to 180°F and minimum 300 psi inlet pressure. Provide model with inlet pressure rating, reduced pressure range and factory preset outlet pressure as scheduled on Contract Drawings.
   10. Manufactured by Wilkins Series 600XL or approved equal by Watts

B. Large Demand Systems
   1. Sizes 1-1/4” through 2 - ASTM B62 bronze body
   2. Sizes 2-1/2” and larger - ASTM A536 ductile iron body
   3. Pressure reducing pilot control
   4. Stainless steel disc guide, seat and bearing cover
   5. Stainless steel stem, nut and spring
   6. FDA approved Nylon reinforced Buna-N rubber diaphragm
   7. Provide model(s) with size, temperature range, inlet pressure rating, reduced pressure range, outlet pressure and options as scheduled on Contract Drawings.
   8. Cla-Val Company Series 90 or approved equal by Watts

2.29 WATER HAMMER ARRESTORS

A. Manufacturers: Watts Series LF15M2 Series or approved equal.

B. ANSI A112.26.1; copper construction, piston type sized in accordance with PDI WH-201.

C. Pre-charged suitable for operation in temperature range 33 to 180 degrees Fahrenheit and maximum 150 psi working pressure.

D. Access Panel: Acorn Model 8292 or approved equal.

E. Lead Free.

2.30 THERMOSTATIC MIXING VALVES:

A. Manufacturers:
   1. Leonard.
   2. Acorn controls.
   3. Power.
   4. Bradley.
   5. Zurn/Wilkins.

B. Certified to ASSE Standard 1017, ASSE 1070, and meets the anti-scald requirements of ASSE Standard 1016.

C. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

D. Capacity:
1. TMV-1: Flow capacity between 0.35 gpm Min. and 4 gpm Max. at 5 psi pressure drop. Lead Free.
   a. Model:
      (1) Lawler 1070 Series
      (2) Leonard – 170-LF
      (3) Acorn controls - ST70CP-38
      (4) Power - LFLM495
      (5) Zurn/Wilkins – ZW3870XLT-4P
2. TMV-2: 3 gpm Min. and 14 gpm Max. at 5 psi pressure drop. Lead Free
   a. Model:
      (1) Lawler 66-25
      (2) Leonard – LV-186-982-LF-STSTL-REC.
      (3) Acorn controls – SFMV Series
      (4) Power – ETV200
      (5) Bradley – TMV-25
3. TMV-3: 3 gpm Min. and 30 gpm Max. at 5 psi pressure drop. Lead Free
   a. Model:
      (1) Lawler 66-80
      (2) Leonard – LV-186-983-LF-STSTL-REC.
      (3) Acorn controls – SFMV Series
      (4) Power – ETV200
      (5) Bradley – TMV-80

E. Accessories:
1. Check valve on inlets.
2. Volume control shut-off valve on outlet.
3. Stem thermometer on outlet.
4. Strainer stop checks on inlets.

F. Cabinet: 16 gage stainless steel, for recessed mounting with keyed lock.

G. Mechanical Rooms: Omit cabinet, surface mount.

H. Mount:
1. TMV-1 in piping under lavatory/sink/etc.
2. TMV-2 in wall mounted stainless steel cabinet.
3. TMV-3 in wall mounted stainless steel cabinet

I. Lead Free.

2.31 SOLENOID VALVES

A. ASCO Series Next Generation

B. Provide at each kitchen cooking hood and at each science lab prep room and demo table where for automatic gas supply shut-off.

C. Coordinate electrical connections with Division 26.

2.32 TEMPERATURE INSTRUMENTS

A. Manufacturer: Trerice, Taylor, Marsh, Weksler, Marshalltown, Weiss, or Miljoco.

B. Thermometer Wells.

1. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction.
2. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
3. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
4. Wells shall be sized to extend a minimum of 50% into pipe

2.33 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Coordinate required voltage, wire size and over current device size with electrical drawings. Contractor shall provide all electrical connections per manufacturer's installation instructions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment on concrete housekeeping pad, minimum 4 inches high and six (6) inches larger than water heater base on each side. Refer to Section 03 30 00

B. Install water heater with the followings.

1. Maintain manufacturer's recommended clearances around and over water heaters.

2. Connect natural gas piping in accordance with NFPA 54.

3. Provide water heater pan beneath all water heaters with 3/4-inch drain to nearest floor sink.

4. Connect natural gas piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.

5. Install the following piping accessories.

a. On supply:

(1) Thermometer well and thermometer.

(2) Strainer.

(3) Pressure gage.

(4) Shutoff valve.

(5) Diaphragm-type expansion tank

b. On return:

(1) Thermometer well and thermometer.

(2) Pressure gage.

(3) Shutoff valve.

6. Install the following piping accessories on natural gas piping connections.

    a. Strainer.

    b. Pressure gage.

    c. Shutoff valve.

    d. Pressure reducing valve.

7. Install discharge piping from relief valves and drain valves to nearest floor drain.

8. Install circulator and diaphragm expansion tank on water heater.

9. Install water heater trim and accessories furnished loose for field mounting.

10. Install electrical devices furnished loose for field mounting.

11. Install control wiring between water heater control panel and field mounted control devices.

12. On gas-fired equipment connect flue to water heater outlet, full size of outlet.

13. Provide factory start-up and demonstration, including operating instructions for all gas-fired water heaters. Schedule training sessions with Architect and Owner's representative. Provide certification letter from manufacturer indicating water heater is installed in accordance with manufacturer's instructions.

C. Circulating Pump Installation: Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

1. Install the following piping accessories.

    a. On supply:

        (1) Pressure gage.

        (2) Shutoff valve.

        (3) Check valve.

    b. On return:

        (1) Thermometer well and thermometer.

        (2) Timer.

        (3) Pressure gage.

        (4) Shutoff valve.

D. Water softener: Install system components according to manufacturer’s published recommendations and pipe as indicated on Drawings. Care shall be exercised in

fabricating plumbing lines to avoid all cross connections eliminate the possibility of water contamination.

1. Provide and install double check valve assembly backflow prevention on the potable water line serving the water softener downstream of all potable water connections serving any other outlets or equipment.

2. Backflow preventers shall be duplexed where located within lines serving in-patient areas, critical research areas, and/or any area or equipment where un-interruptible (twenty-four hour) water service is required.

3. Provide a physical air gap of at least two times the diameter of the softener equipment drain piping discharging into a floor drain/sink receptor.

4. Provide for the service of a competent supervising agent from the water softener manufacturer to inspect the completed installation, start the water softening system in operation and acquaint the operators with the proper operation and maintenance of the equipment.

E. Backflow Preventers and Vacuum Breakers.

1. Isolate all non-potable water requirements from the building domestic water system with backflow prevention device manufactured and certified for the particular application.

2. Pipe relief from backflow preventer indirectly to drain of sufficient size to evacuate maximum flow discharge.

3. Backflow preventers shall be duplexed full-size where located within domestic water lines serving in-patient areas, critical research areas, and/or any area or equipment where un-interruptible (24 hour) water service is required.

4. Test ports shall not be located more than 72 inches above finished floor or permanent platform.

5. Do not install vacuum breakers or backflow preventers above equipment, above ceilings, concealed within walls, or areas where water leakage can cause damage.

6. Install a strainer immediately upstream of each vacuum breaker and backflow preventer.

F. Water Hammer Arrestors (Hydraulic Shock Absorbers).

1. Provide hydraulic shock absorbers in cold and hot water supply lines to each fixture branch, battery of fixtures and at each automatic, solenoid-operated or quick-closing valve serving equipment.

2. Locate and size hydraulic shock absorbers in accordance with PDI-WH-201 Standard and manufacturer’s published recommendations.

3. Install hydraulic shock absorbers with clearances to allow inspection, removal and replacement. Provide access panels where required.

G. Water Pressure Regulating Valves.

1. Provide isolation valve, strainer and pressure gauge immediately upstream of each pressure regulating valve.

2. Provide pressure gauge and isolation valve immediately downstream of each pressure regulating valve.

3. Installation shall allow sufficient access to and space around components for adjustments and servicing.

4. Provide services of a direct factory representative for start-up service, inspection and necessary adjustments for all large demand regulators

H. Grease traps shall be cleaned and pumped prior to substantial completion. Interior joints shall be properly sealed.

I. Install diaphragm-type expansion tank on cold water supply line.

J. Install flow meter on cold water supply line and gas line at point of entry. Coordinate with div. 23 (BAS) for signal output and div. 26 for power requirements.

K. Sewer and Sump pump Discharge Piping:

1. Factory or field fabricated, galvanized, ASTM A53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class125, cast-iron flange and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings.

2. Underground piping shall be Copper Tubing: ASTM B88, Type K. Fittings: ASME B16.22 wrought copper and bronze. Joints: AWS A5.8, BCuP silver braze.

END OF SECTION 22 30 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SECTION 22 05 00 – COMMON WORK RESULT FOR PLUMBING

C. SECTION 22 05 16 – EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

D. SECTION 22 05 29 – PLUMBING PIPE HANGERS AND SUPPORTS

E. SECTION 22 05 48.13 – VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.2 SUMMARY

A. Provide a complete system of plumbing fixtures and trim.

B. All materials and equipment for the potable water system shall meet the latest mandates and requirements for lead free required by law that goes into effect January 2014.

1.3 SUBMITTALS

A. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.5 EXTRA MATERIALS

A. Furnish two sets of faucet washers flush valve service kits lavatory supply fittings shower heads toilet seats.

PART 2 - PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. Fixture Manufacturers:
   1. American Standard.

   2. Kohler Co.

B. Fixture Trim Manufacturers:
   1. Bemis
   2. Beneke
   3. Sloan Valve Co.

C. WC-1: ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top back spud, china bolt caps. Provide as indicated on plumbing fixture schedule.
   1. Wall Mounted: American Standard 3351.101.020
   2. Or as indicated on schedules.
   3. Trim : (Type C)

D. WC-2: Same as WC-1, except mounted at ADA/TAS height for appropriate age group.
   1. Wall Mounted: American Standard 3351.101.020
   2. Or as indicated on schedules.
   3. Trim : (Type C)
   4. Provide flush valve stem offset as required.

E. Trim:
   1. Exposed Flush Valve (Type C): ASME A112.18.1; exposed chrome plated, diaphragm type with non-hold open handle, escutcheon, seat bumper, 2” offset flush connection, integral screwdriver stop and vacuum breaker; maximum 1.28 gallon. Sloan Model Royal series.

F. Seat: White plastic, open front, extended back, self-sustaining hinge, stainless steel mounting hardware, brass bolts, with without cover. Manufacturer: Bemis, Beneke. Bemis 1655SSCT or provide as indicated on plumbing fixture schedule.

G. Wall Mounted Carrier: ASME A112.6.1; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. Jay R. Smith 200 series carriers, or equal by zurn and watts.

2.2 WALL HUNG URINALS

A. Fixture Manufacturers:
   1. American Standard Plumbing.
   2. Kohler Co.

B. Fixture Trim Manufacturers:
   1. Sloan.

C. All urinal flush valves shall meet the latest mandates and requirements for lead free required by law that goes into effect January 2014.

D. U-1: ASME A112.19.2M; vitreous china, wall hung, elongated rim integral trap, removable stainless steel strainer, 3/4 inch top spud, provide chair carrier as required. American Standard Pintbrook Model 6002.001 or provide as indicated on plumbing fixture schedule.
   1. Trim : (Type C)

E. U-2: Same as U-1, except mounted at ADA/TAS height for appropriate age group.
   1. Trim : (Type C)

F. Trim:
   1. Exposed Flush Valve (Type C): ASME A112.18.1; exposed chrome plated, diaphragm type with non-hold open handle, escutcheon, integral screwdriver stop with vandal resistant stop cap, vacuum breaker; maximum one (1) pint flush volume. Sloan Model Royal series.

G. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with rectangular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs. Provide bottom bearing plate. Jay R. Smith figure 0637, or equal by Zurn and watts or provide as indicated on plumbing fixture schedule.

2.3 LAVATORIES

A. Fixture Manufacturers:
   1. American Standard Plumbing.
   2. Kohler Co

B. Fixture Trim Manufacturers:
   1. Chicago.

C. Supply Fittings Manufacturers:
   1. Chicago.
   2. McGuire.
   3. Brasscraft.
   4. Zurn.

D. All lavatory faucets and trim shall meet the latest mandates and requirements for lead free required by law that goes into effect January 2014.

E. L-1, Vitreous China Wall Hung Basin: ASME A112.19.2M; American Standard 0355.012 vitreous china wall hung lavatory 21 x 18 inch minimum, with four (4) inch high back, 3 deck holes, rectangular basin with splash lip, front overflow, and soap depression. Provide floor mounted carrier for correct lavatory type. Provide as indicated on plumbing fixture schedule.
   1. Provide at student-only restrooms trim type A1
   2. Provide at faculty-only restrooms trim type E1

F. L-2, Vitreous China Wall Hung Basin: ASME A112.19.2M; American Standard 0356.421 vitreous china wall hung lavatory 21 x 18 inch minimum, with four (4) inch high back, single deck hole, rectangular basin with splash lip, front overflow, and soap depression. Provide floor mounted carrier for correct lavatory type. Provide as indicated on plumbing fixture schedule.
   1. Provide at student-only restrooms trim type A1
   2. Provide at faculty-only restrooms trim type E1

G. Trims:
   1. Supply Fitting: ASME A112.18.1 (Type A1); chrome plated brass spout, metering valve cartridge, supply fitting with open grid strainer, water economy aerator with

maximum 0.5 gpm flow, ADA compliant. Chicago 802-VE2805-665ABCP or provide as indicated on plumbing fixture schedule.

2. Supply Fitting: ASME A112.18.1 (Type E1); chrome plated brass spout, quantum compression operating cartridge, supply fitting with open grid strainer, water economy aerator with 0.5 gpm flow, ADA compliant. Chicago Faucet 895-317E2805-5ABCP.

H. Accessories:
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2. Chrome plated 17 gage open grid P. O. plug.

3. Removable key stops.

4. Flexible supplies.

5. Trap and waste insulated and offset to meet ADA compliance.

6. Tempering valve – Power LFe480 series, Acorn, or Leonard.

I. Floor Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, concealed arm supports, bearing plate and studs. Jay R. Smith 710 Series, or equal by Zurn and watts.

2.4 SINKS

A. Fixture Manufacturers:
1. Elkay Mfg.

2. Just

B. Fixture Trim Manufacturers:
1. Chicago Faucet Co.

C. Supply Fittings Manufacturers:
1. Chicago.

2. McGuire.

3. Brasscraft.

4. Zurn.

D. All sink faucets and trim shall meet the latest mandates and requirements for lead free required by law that goes into effect January 2014.

E. SK-1: Single Compartment Bowl: ASME A112.19.3; 19-1/2 x 19-1/2” x 6-1/2 inch outside dimensions, 18 gage thick, Type 304 stainless steel. Self-rimming and undercoated, with 1-1/2 inch chromed brass stainless steel drain, ledge back drilled for trim. Elkay Model LRADQ191965PD or provide as indicated on plumbing fixture schedule.
1. Trim: ASME A112.18.1 (Type J1): chrome plated brass supply with rigid spout, 4” vandal proof wrist blade, water economy aerator with 0.5 gpm. Mechanical

faucet deck mounted 8” fixed Center, dual supply for hot and cold water service Chicago Faucets Model 201-AGN8AE2805-F-317CP.

F. SK-2: Double Compartment Bowl: ASME A112.19.3; 33 x 19-1/2 x 6-1/2 inch outside dimensions 18 gage thick, Type 304 stainless steel. Self-rimming and undercoated, with 1-1/2 inch chromed brass stainless steel drains 3-1/2 inch crumb cups and tailpieces, ledge back drilled for trim. Elkay Model LRADQ331965PD or provide as indicated on plumbing fixture schedule.
   1. Trim: ASME A112.18.1 (Type J1): chrome plated brass supply with rigid spout, 4” vandal proof wrist blade, water economy aerator with 0.5 gpm. Mechanical faucet deck mounted 8” fixed Center, dual supply for hot and cold water service Chicago Faucets Model 201-AGN8AE2805-F-317CP.

G. SK-3: Single Compartment Bowl: ASME A112.19.3; 25” x 21-1/4” x 6-1/2” outside dimensions, 18 gage thick, Type 304 stainless steel. Self-rimming and undercoated, with 1-1/2 inch chromed brass stainless steel drain, ledge back drilled for trim. Elkay Model LRADQ252165PD or provide as indicated on plumbing fixture schedule.
   1. Trim: ASME A112.18.1 (Type J1): chrome plated brass supply with rigid spout, vandal proof water economy aerator with 0.5 gpm flow, 8” fixed center, 4” vandal proof Wrist blade Chicago Faucet Model 201-G8AE2805F317AB.

H. SK-4: Single Compartment Bowl: ASME A112.19.3; 16-3/4” x 15-1/2” x 6” outside dimensions, 20 gauge, Type 304 stainless steel with a buffed satin finish, center drain. Advanced Tabco Model #7-PS-50 ADA or provide as indicated on plumbing fixture schedule.
   1. Trim: Included with gaucet. Wall mount faucet with 4” Gooseneck Spout 2” Lever handles 1/2” offset inlets. Vandal resistant aerator standard with 1.5 gpm, chrome plate brass with quarter turn ceramic disc valve and requires 2 faucet.

I. SK-5: Single Compartment Bowl floor mount: ASME A112.19.3; 21” x 26” x 14” outside dimensions, 14 gauge, Type 304 stainless steel with a buffed satin finish, center drain. Advance Tabco FS-1-1620 or provide as indicated on plumbing fixture schedule.
   1. Trim: (Type L2) ASME A112.18.1; 8” centerset wall mount faucet with 8” arch tube spout 2” lever handles 2” inlet chrome. Vandal resistant aerator standard with 1.5 gpm, chromo plate brass with quarter turn ceramic disc valve and requires 2 faucet. Elkay Faucet Model LK945AT08L2T.

J. Accessories:
   1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   2. Chrome plated 17 gage brass basket strainer.
   3. Removable key stops.
   4. Flexible supplies.
   5. Trap and waste insulated and offset to meet ADA compliance.

K. Provide offset waste on all sinks.

2.5 LAB SINKS (LS-X)

A. Fixture Manufacturers:
   1. Elkay Mfg.

2. Just

B. Fixture Trim Manufacturers:
1. Chicago Faucet Co.

C. Supply Fittings Manufacturers:
1. Chicago.

2. McGuire.

3. Brasscraft.

4. Zurn.

D. LS-1: Single Compartment Bowl: ASME A112.19.3; 19-1/2 x 19-1/2" x 6-1/2 inch outside dimensions, 18 gage thick, Type 304 stainless steel. Self-rimming and undercoated, with 1-1/2 inch chromed brass stainless steel drain, ledge back drilled for trim. Elkay Model LRADQ191965PD or provide as indicated on plumbing fixture schedule.
1. Provide units that comply with SEFA 7, Laboratory Fixtures. Provide Chicago Model LWM11-A11-G faucet & fittings or as indicated on Drawings, complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

E. LS-2: Single Compartment Bowl: ASME A112.19.3; 19-1/2 x 19-1/2" x 6-1/2 inch outside dimensions, 18 gage thick, Type 304 stainless steel. Self-rimming and undercoated, with 1-1/2 inch chromed brass stainless steel drain, ledge back drilled for trim. Elkay Model LRADQ191965PD or provide as indicated on plumbing fixture schedule.
1. Provide units that comply with SEFA 7, Laboratory Fixtures. Provide Chicago Model LWM11-B13-G faucet & fittings or as indicated on Drawings, complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

F. Provide stainless steel strainer, outlet, standpipe overflow, and stopper for all sinks unless otherwise specified.

G. Provide tailpieces and trap compatible with waste piping systems for all sinks unless otherwise specified.

H. Preparation: Provide openings, accesses, cutouts, etc., in casework units and tops as necessary to permit installation of fittings at the Project Site.

I. Provide undercounter thermostatic mixing valve at each lab sink per code.

J. Equip valve handles with color coded plastic index buttons as follows:

Service	Indexing	Button Color	Lettering Color
Cold Water (Potable)	CW	Green	White
Hot Water (Potable)	HW	Red	White

2.6 LAVATORY and SINK INSULATION KIT

A. Manufacturers:
1. Truebro/IPS
2. Plumberex
3. Zurn

B. Product Description: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.7 SHOWERS (Regular) – (SH-1)

A. Manufacturers:
1. Acorn Engineering Company.

2. Powers

B. SH-1: ASME A112.18.1; concealed shower supply with pressure balanced or thermostatic mixing valves, integral service stops, chrome plated vandal-proof institutional head with integral wall mounting flange, built-in 1.5 gpm flow, and escutcheon. Acorn – SV16-LVR – 519 - MSH - F1.5 or provide as indicated on plumbing fixture schedule.

2.8 SHOWERS (ADA) – (SH-2)

A. Manufacturers:
1. Acorn Engineering Company.

2. Powers.

B. SH-2 ADA: ASME A112.18.1 and ASSE 1016-2011; concealed shower supply with pressure balanced and thermostatic mixing valves, integral service stops, hand held shower () with 69 inch metal clad hose and 24 inch glide mounted on right hand side (), flow rate 1.5 GPM. ACORN – SV16-LVR – HHC15 - HHSH - HHSE - IVB – SB – PK or provide as indicated on plumbing fixture schedule.

2.9 SHOWER (Regular) – (SH-3)

A. Manufacturers:
1. Acorn Engineering Company.

2. Powers

B. SH-3: ASME A112.18.1; Wall mounted shower systems, slow compression-type volume control/shutoff, H-06 institutional shower head, 1.6 GPM. Factory pre-assembled with 18 gauge stainless steel cover, exposed parts chrome plated, vandal resistant. Acorn 450B or provide as indicated on plumbing fixture schedule.

2.10 ELECTRIC DRINKING FOUNTAIN

A. Manufacturers:
1. Elkay Mfg.

2. Halsey Taylor

B. Supply Fittings Manufacturers:
1. Chicago.

2. McGuire.

3. Brasscraft.

4. Zurn.

C. All electric water coolers shall meet the latest mandates and requirements for lead free required by law that goes into effect January 2014.

D. Fountain: (EDF-1) Indoor With Bottle Filler
1. ARI 1010; (ADA) Hydroboost bottle filling station, bi-level cooler, wall mount, non-filtered 8 GPH Stainless. Mechanically activated, sanitary sensor activated, green counter, laminar flow, antimicrobial, real drain. Electronic bottle filler sensor with mechanical front and side bubbler pushbar. Halsey Taylor Model HTHB-HAC8BLSS-NF provide as indicated on plumbing fixture schedule.

2. Capacity: 7.6 gph of water with inlet at 80 degrees F and room temperature of 90 degrees Fahrenheit.
3. Electrical: 115V / 60HZ. Maximum 1/5 hp compressor, cord and plug for connection to electric wiring system including grounding connector.

4. Provide cane touch apron, Halsey Taylor Model 42522 for HAC Series or provide as indicated on plumbing fixture schedule.

2.11 EMERGENCY COMBINATION SHOWER WITH EYE AND FACE WASH (EW-X)

A. Manufacturers:
1. Guardian Safety Equipment

B. Barrier Free, all stainless steel construction, corrosion resistant, combination eye/face wash and shower safety station with stainless steel shower head, stainless steel bowl, stainless steel flag handle and floor flange, 1 ¼" IPS Schedule 40 stainless steel pipe and fittings, 1" IPS and ½" IPS U.S. made stainless steel stay open ball valves, and polished stainless steel pull rod. Unit shall have (4) polypropylene 'GS Plus' spray heads with integral "flip-top" dust covers, filters, and 1.8-GPM flow control orifices mounted on a stainless steel head assembly. Unit shall include ANSI compliant sign.

C. Performance: Unit complies with ADA requirements for accessibility by handicapped persons. Unit shall meet or exceed ANSI Z358.1 – 2004, and come with a full 2-year warranty.

D. Fixture:

1. (EW-1): Guardian Equipment GBF 2150SSH-PCC (recessed in-wall). Shall be provided at all science lab and prep room emergency fixtures, and where install is constructable with lay-in or gyp ceiling.

E. Alarm Option:
1. AP275-200 alarm unit, with light and horn. (blue color light) Light and horn shall be installed in corridor outside of science lab (120 VAC, 0.5 AMP).

2. Locate the blue light in the ceiling of the main corridor area directly outside room where emergency shower is installed. Provide one light per shower/valve configuration. Guardian AP280-235 (120v/1/60hz – 0.11 amp) for GBF 2150SSH-GC and Guardian AP280-230 (120v/1/60hz – 0.11 amp) for GBF 1909SSH-GC

F. Hot water Option: TMV G3800LF Thermostatic mixing valve per ANSI Z358.1-2014.

G. Supply and Waste Piping: 1-1/4 inch galvanized steel pipe pedestal with floor flange.

H. Route eyewash bowl waste out back of unit and concealed into wall, route down below floor to connect to the vertical waste of the floor drain (upstream of the p-trap) under the emergency shower head.

I. Furnish universal emergency sign.

2.12 SERVICE SINKS (SS-1)

A. Manufacturers:
1. Fixture Manufacturers:
a. Stern Williams

2. Fixture Trim Manufacturers:
a. Stern Williams

B. SS-1: Single bowl 24 x 36 x 12 inch high. Receptor composed of pearl grey marble chips and white Portland cement ground smooth, grouted and sealed to resist stains, floor mounted, with 1-1/4 inch wide shoulders, vinyl bumper guard, stainless steel dome strainer. Stern Williams Model MTB-3624 or provide as indicated on plumbing fixture schedule.

C. Accessories:
1. Sink Fittings: Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Stern Williams Model T-10-VB.

2. Three (3) feet of 5/8 inch diameter plain end reinforced synthetic hose with stainless steel wall bracket. Stern Williams Model T-35.

3. Mop hanger. Stern Williams Model T-40.

4. Or provide as indicated on plumbing fixture schedule.

2.13 FLOOR DRAINS

A. Manufacturers:
1. Josam Mfg.,

2. Jay R. Smith Mfg.,

3. Wade Spec. Products

4. Zurn Industries

5. Mifab

6. Watts

B. Floor Drain (FD-1): ASME A112.21.1; Top round floor drain, lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and

round, adjustable nickel-bronze strainer. Zurn ZN-415-BZ1 (Vandal-Proof Secured Top) or provide as indicated on plumbing fixture schedule. For restroom only.

C. Floor Drain (FD-2): ASME A112.21.1; Top round floor drain, lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable light duty square nickel-bronze strainer with removable perforated sediment bucket. Zurn ZN-415N-P (Vandal-Proof Secured Top) or provide as indicated on plumbing fixture schedule. For Janitor Closet and general space only.

D. Floor Drain (FD-3): ASME A112.21.1; Cast iron flanged receptor with seepage holes, acid resistant coated interior and indirect waste drain, nickel bronze rim and secured grate. Secondary strainer or sediment bucket with. Zurn ZN-1970-KC-11 (Vandal-Proof Secured Top) with 4" funnel drain for freezer drain only or provide as indicated on plumbing fixture schedule. For Kitchen and AHU area

E. Floor Drain (FD-4): ASME A112.21.1;medium duty drains with 9" round top, duco cast iron body and flashing collar with cast iron bar. Zurn ZN-550 (Vandal-Proof Secured Top) or provide as indicated on plumbing fixture schedule. For Central Plant area

2.14 FLOOR SINKS

A. Manufacturers:
1. Josam Mfg.
2. Jay R. Smith Mfg.
3. Wade Spec. Products
4. Zurn Industries
5. Mifab
6. Watts

B. Floor Sink (FS-1): Cast iron body with integral seepage pan, acid resistant interior, nickel bronze rim and secured 1/2 grate. Aluminum dome bottom strainer and eight (8) inch square top. Zurn ZN-1910-K Series (Vandal-Proof Secured Top) or provide as indicated on plumbing fixture schedule. For Kitchen and AHU area

C. FS-2: Zurn ZN-1900-KC, 12 inches, 3/4 grate (Vandal-Proof Secured Top) or provide as indicated on plumbing fixture schedule. For Kitchen

D. FS-3: Zurn ZN-1900-KC, 12 inches, 1/2 grate (Vandal-Proof Secured Top) or provide as indicated on plumbing fixture schedule.

2.15 TRAP PRIMERS

A. Provide trap primers by PPP or approved equal

2.16 CLEANOUTS

A. Cleanouts shall be provided where indicated on Drawings and elsewhere as required by code.
1. Cleanouts in pipelines shall consist of cast iron ferrule and heavy duty cleanout plug with square head as scheduled on the Drawings. Where piping is

concealed in floors or walls cleanouts shall be installed in or near surface of floor or walls and have countersunk plugs with covers

B. Cleanouts shall be provided at the base of the stack on all sanitary, waste and drainage stacks. Base of stack cleanouts on piping located within walls or partitions shall be cast iron cleanout tee with countersunk plug and chromium-plated round access cover, J.R. Smith figure or approved equal.

C. Manufacturers:
1. Josam Mfg.
2. Jay R. Smith Mfg.
3. Wade Spec. Products
4. Zurn Industries
5. Mifab
6. Watts

D. Floor, Outdoors (DCOTG or COTG): Coated cast iron body with gasket seal ABS plug and round cast iron scoriated non-skid cover. Jay R. Smith, Model 4220-F-C-U. Also provide where indicated via the symbols legend on the plumbing cover sheet.

E. Floor, Indoors (FCO): Coated cast iron body with gasket seal ABS plug, threaded top assembly with round nickel bronze scoriated cover in service areas. Jay R. Smith, Model 4025 – F-C-U. Also provide where indicated via the symbols legend on the plumbing cover sheet.

F. Wall Cleanout (WCO): Line type with lacquered cast iron body with bronze taper thread plug and round stainless steel access cover secured with vandal proof screw. Jay R. Smith Model 4420-U.Also provide where indicated via the symbols legend on the plumbing cover sheet.

G. Floor, Stainless Steel Indoors (FCO-SS): Coated cast iron body with gasket seal ABS plug, threaded top assembly with round stainless steel scoriated cover in service areas. Jay R. Smith Model 9760 Series.

2.17 HOSE BIBS

A. Manufacturers:
1. Josam Mfg.
2. Jay R. Smith Mfg.
3. Woodford
4. Zurn Industries
5. Chicago
6. Wade

B. HB-1:

1. Manufacturers: Woodford Model B24 or provide as indicated on plumbing fixture schedule.

2. Interior: Polish brass, anti-siphon, vacuum breaker, enclosed in flush mounted wall box and adjustable brass nut with deep stem guard.

C. HB-2:
1. Manufacturers: Woodford Model B65, or provide as indicated on plumbing fixture schedule.

2. Interior: Polish brass Bronze, automatic draining freezeless wall hydrant, single check hose connection anti-siphon vacuum breakers, hydrants drain as handle shut off , permanent type brass valve body with hemispherical seating surface.

D. HB-3:
1. Manufacturers: Woodford Model 24 or provide as indicated on plumbing fixture schedule.

2. Interior: Polish brass, anti-siphon, vacuum breaker and adjustable brass nut with deep stem guard.

2.18 WALL HYDRANTS

A. Manufacturers:
1. Josam Mfg.

2. Jay R. Smith Mfg.

3. Woodford.

4. Zurn Industries

5. Mifab

6. Watts

B. Exterior Wall Hydrant (WH-1):
1. Woodford RB65, Non-Freeze, or provide as indicated on plumbing fixture schedule.

2. ASSE 1019; Chrome, non-freeze, self-draining type with lockable recessed box hose thread spout, hand wheel locks shield and removable key, and integral vacuum breaker.

C. Back of the House Wash (WH-2):
1. Woodford B22, Non-Freeze, or provide as indicated on plumbing fixture schedule.

2. Wall Hydrant : ASSE 1019; non-freeze, self-draining type with lockable recessed box hose thread spout, hand wheel locks shield and removable key, and integral vacuum breaker for hot and cold water.

D. Kitchen Yard Hydrant (WH-3):
1. Woodford HCB67, ASSE 1019, or provide as indicated on plumbing fixture schedule.

2. Lockable box type, non-freeze hot and cold mixer, chrome finish with permanent type brass valve body with hemispherical seating surface, automatic draining and hose connection, backflow preventer and check valve.

2.19 RECESSED VALVE BOX

A. Manufacturers: Guy Gray, or approved equal.

B. RVB-1, Refrigerator/Ice Machine: Stainless steel preformed rough-in box with brass valves with wheel handle slip in finishing cover. IPS Model SSMIB8AB.

C. RVB-2, Washing Machine: Galvanized steel preformed rough-in box with brass long shank valves with wheel handles, valves with single lever handle, socket for two (2) inch waste, slip in finishing cover. IPS Model SSWB-3.

2.20 DOWNSPOUT OVERFLOW NOZZLE

A. Hinged Cover Style:
   1. Manufacturers: Jay R. Smith 1775-U Series or provide as indicated on plumbing fixture schedule.
   2. Product Description: Fabricated Type 304 Stainless Steel Downspout Cover with Hinged Perforated Cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 13 - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key or screwdriver stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.

F. For ADA accessible water closets, install flush valve with handle to wide side of stall.

G. Emergency Shower: Provide a floor drain at each shower installation. Jay R. Smith Model 2005-A07NB-P or provide as indicated on plumbing fixture schedule.

H. Ice maker: Provide floor sink and cold-water outlet RVB-1 to each location. Coordinate with Architecture Drawings prior to rough-in. Ensure drains are located at low point(s) of floor slope.

I. Water Heater: Provide floor drain to each location. Coordinate with Architecture Drawings prior to rough-in. Ensure drains are located at low point(s) of floor slope.

J. Janitor Closet: Provide floor drain to each location. Coordinate with Architecture Drawings prior to rough-in. Ensure drains are located at low point(s) of floor slope.

K. Commercial Washer: Provide floor drain to each location. Coordinate with Architecture Drawings prior to rough-in. Ensure drains are located at low point(s) of floor slope.

L. Washing Machine: Provide Hot and cold water outlet RVB-2 to each location. Coordinate with Architecture Drawings prior to rough-in.

M. Provide power wiring, including control power transformers as required for all sensor type fixtures.

N. Bolt carriers to the floor.

O. All sinks shall have an offset rear centered drain.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. Hot water temperature outlet at each sink and lavatory shall be adjusted to 105 degree F maximum except for water supplying clothes washing machines and kitchen equipment which shall supply with 140 degree F.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit use of fixtures before final acceptance.

END OF SECTION 22 40 00

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide all work for mechanical, plumbing and fire protection systems required in the project to be properly installed, tested, and performing their intended function.

1.3 QUALITY ASSURANCE

A. Perform all work in accordance with the latest edition of the applicable codes, specifications, local ordinances, industry standards, utility company regulations, nationally accepted codes.

B. All materials and distribution, and utilization equipment shall be UL Listed.

C. All equipment and materials shall be new, unused and of United States Domestic manufacture unless approved otherwise by engineer or owner.

D. Eliminate any abnormal sources of noise that are considered by the Architect or Engineer not to be an inherent part of the systems as designed without additional cost to the Owner.

1.4 GENERAL REQUIREMENTS

A. No portion of the total contract will be declared substantially complete until the automatic temperature control system (BAS) has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of set point.

B. All HVAC equipment warranties shall begin at substantial completion; warranties shall not begin at equipment start up or shipment.

1.5 COORDINATION WITH OTHER TRADES

A. Coordinate the work of this division with all other divisions to ensure that all components of the mechanical, plumbing and fire protection system will be installed at the proper time and fit the available space.

B. Locate and size all openings in work of other trades required for the proper installation of the mechanical, plumbing and fire protection system components.

C. Make all mechanical, plumbing and fire protection connections to all equipment furnished by this division and as required by any other division.

D. Electrical wiring, control equipment and motor starters indicated on the electrical drawings, except items otherwise specifically noted, shall be furnished, and installed by the electrical trades. Items of electrical control equipment specifically mentioned to be

furnished by the mechanical trades, either in these specifications or on the mechanical drawings, shall be furnished, mounted, and wired by this trade unless where otherwise specified in Division 26 or noted on the electrical drawings to be by the electrical trades. All wiring shall be in accordance with all requirements of the electrical Sections of these specifications.

E. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment. All controllers furnished with mechanical equipment shall have overload protection in all phases. It shall be the responsibility of each subcontractor furnishing motors and devices to advise Electrical Contractor of exact function of systems to assure proper type of starter with correct number auxiliary contacts for proper operation of the system.

F. The mechanical trades shall coordinate with the electrical contractor to ensure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

G. The design of the electrical systems is based on the mechanical equipment scheduled and shown on the drawings. Where changes or substitutions are made that involve additional electrical work (larger-size motors, larger number of motors, additional wiring of equipment, etc.), the mechanical contractor shall be responsible for added cost and coordination with the electrical subcontractor. The mechanical contractor shall pay the electrical trades for the cost of the additional work and materials except for changes by addendum.

H. Motor control equipment which is furnished loose under Division 23 shall be delivered to the Electrical Contractor at the site for custody, erection in place, and wiring as specified.

I. Smoke detection systems will be furnished and installed under Division 26 – electrical. Coordinate locations with Electrical Contractor.

1.6 DRAWINGS

A. The drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Determine exact locations by review of equipment manufacturer's data, by job site measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The size of the mechanical, plumbing and fire protection equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment that the Contractor proposes to furnish will fit in the space. The drawings are not intended to show exact locations of pipes and ducts, or to indicate all offsets and fittings or supports, but rather to indicate approximate layout.

B. The mechanical, plumbing and fire protection Drawings are necessarily diagrammatic in character and cannot show every connection in detail in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. When the mechanical, electrical, plumbing and fire protection Drawings do not give exact details as to the elevation of pipe, conduit, and ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Exposed piping and ductwork are generally intended to be installed true and square to the building construction and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

1.7 SUBMITTALS

A. Provide shop drawings and complete product data as indicated in each specification section.

B. Coordination Drawings: Using the mechanical ductwork shop drawings as a basis, provide a composite set of AutoCAD drawings in which the major mechanical, plumbing and fire protection equipment, ductwork and piping are superimposed on the architectural reflected ceiling plan and structural framing plan. Include spot elevations of bottom of steel along with finished ceiling height. Prepare at 1/8-inch scale or larger, one drawing per building area. Provide 1/4-inch scale enlargements of locations where special attention to rough-in dimensions as required to ensure all systems will fit within the available space. Obtain approval of coordination drawings prior to duct fabrication and mechanical system hanger rough-ins.

C. All mechanical equipment and routings shown are schematic in nature. Prior to beginning any construction work, the mechanical contractor shall furnish as part of the mechanical equipment submittals, a ¼” = 1’-0” scaled drawing of all proposed mechanical equipment. Indicate scaled accurate sizes and characteristics of proposed equipment as well as manufacturers minimum required clearances, piping routing, etc. to allow the architect, engineer, and Lamar Consolidated ISD Facilities Department and Bond Program Office the opportunity to approve the proposed layout. If the proposed layout is not acceptable the contractor shall modify the proposed equipment layout and / or routing as required in order to gain approval from the Engineer, Architect, and Lamar Consolidated ISD.

D. Shop Drawings will be reviewed and returned to the Contractor with one of the following categories:

1. **Reviewed**: No further submittal action is required. Submittal to be included in O & M Manual.

2. **Revise and Resubmit**: Contractor to resubmit submittal as indicated in comments section of Engineer's Submittal Cover Letter.

3. **Rejected**: Contractor to resubmit new submittal when alternate or substitution is not approved and be required to furnished product named in Specification and or Drawings.

4. **Furnish as Corrected**: Contractor to submit letter verifying that required corrections noted on Engineer's Submittal Cover Letter have been received and complied with by manufacturer. If equipment on site is not in compliance with corrections noted, contractor shall be responsible for the cost of removing and replacing equipment.

D. Materials and equipment which are purchased or installed without Submittal review and approval will be removed and replaced with specified equipment at Contractor's expense.

E. Provide a specification review that consists of a copy of related specification section with notations indicating compliance or deviation with each element of specification.

1.8 SUBSTITUTIONS OF PRODUCTS

A. The products described in the Proposal Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an Addendum as a substitution prior to the submission of proposals.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect and Engineer at a minimum of seven (7) business days prior to the date for receipt of proposals. Each such request shall include a specification line by line review annotated to certify compliance, the name of the manufacturer and model, material or equipment for which it is to be substituted and a complete description of the proposed substitute including dimensional drawings, cutsheets, performance and test data and any other information necessary for an evaluation. The Engineers decision of approval or disapproval of a proposed substitution shall be final.

C. If the Engineer approves any proposed substitution prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

D. The Engineer and Owner reserve the right to disapprove the use of any manufacturer who in their judgment is unsuitable for use on the Project and that decision will be final.

E. Availability of specified items:

1. Verify prior to submittal of Proposal that all specified items will be available in time for installation during orderly and timely progress of the work.

2. In the event specified items will not be so available, notify the Architect / Engineer prior to receipt of Proposals. Submit Request for Substitutions in accordance with this section.

3. The request will not be considered if the product or method cannot be provided as a result of the Contractor’s failure to pursue the work promptly or coordinate activities properly.

4. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by the Owner.

F. A request constitutes a representation that Offeror:

1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.

2. Will provide same warranty for Substitution as for specified product, except when inability to provide specified Warranty is reason for request for substitution as described above.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse the Owner and pay for all costs, including Architect/Engineer's redesign and evaluation costs resulting from the use of the proposed substitution, or for review or redesign services associated with re-approval by authorities having jurisdiction.

G. <u>No substitutions will be considered after the Award of Contract.</u>

1.9 CLOSEOUT SUBMITTALS

A. Submit in accordance with Division 1 - General Requirements and each specification section.

1.10 INTERFERENCE DRAWINGS

A. Where field conditions prohibit the installation of the mechanical, plumbing or fire protection system components within the available space as indicated on drawings, the Contractor shall prepare a sketch to the minimum 1/8-inch scale, clearly depicting the conflict along with an alternate installation arrangement that satisfies the design intent of the documents without incurring additional cost.

B. Obtain written approval of proposed interference resolution prior to proceeding with alternate installation.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Equipment listed below shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. Contractor shall adequately protect equipment such as but not limited to: Chillers, Air Handling Units, Fan coil Units, Roof top Units, Air Terminal Units, Boilers, Pumps, Air Devices, exhaust fans, variable frequency drives, ductwork, duct insulation, piping insulation, hydronic piping, air duct accessories, unit heaters, etc. from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging; original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

D. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

E. Protect units from physical damage. Leave factory covers in place until startup of machine.

1.12 GENERAL ELECTRICAL REQUIREMENTS

A. Provide electric motors, control panels, certain control and safety devices and control wiring when specified or required for proper operation of electrical systems associated with mechanical equipment specified in Division 23.

B. Electrical materials and work provided shall be in accordance with Division 26.

C. Notify Architect/Engineer in writing 14 days before bids are due if it is necessary to increase horsepower of any motors or change any electrical requirements listed or shown. After this period, costs incurred because of changes shall be assumed by the responsible Contractor.

1.13 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Mechanical equipment with factory assembled and/or attached electric equipment shall be Underwriters' Laboratories (UL) listed as an assembly when such listing is available from UL and shall meet the latest edition of the National Electrical Code.

B. Unless otherwise specified, the electrical supply being furnished is a 460-volt, 3 phase, 3 wire, 60 hertz source. No neutral connection is available from the 460-volt source. The manufacturer shall include any transformers for equipment requiring other voltages (277volt, 220-volt, 120-volt, 24 volt, etc.).

C. Electric Motors:

1. For each piece of equipment requiring electric drive, provide a motor having started and running characteristics consistent with torque and speed requirements of the driven machine.

2. Manufacturers furnishing motors shall verify motor horsepower with the characteristic power curves of driven equipment on shop drawings.

3. Each motor shall be furnished in accordance with Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

4. Contractor shall verify electrical characteristics of each motor with electrical drawings.

5. Motors which are shipped loose from equipment shall be set by supplying subcontractor.

6. Alignment of motors factory coupled to equipment and motors field coupled to equipment shall be rechecked by millwright after all connections (belt drives, gear drives, impellers, piping, etc.) have been completed and again after 48 hours of operation in designed service.

7. Where possible, motors shall be factory mounted.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OWNER INSTRUCTION - GENERAL

A. Installing Contractor shall coordinate and provide on-site Owner training for all new equipment by factory trained specialists for all Mechanical and Plumbing equipment in two (2) separate training meetings. One (1) training session shall be prior to Owner's acceptance and occupancy, and the other training session shall occur (30) thirty days later. Sign-in sheets are required for both meetings and shall be included in close out submittals. Provide a minimum of (6) six hours of training and (6) six hours of demonstration for LCISD staff with video recording.

B. Use Operation and Maintenance manuals and actual equipment installed as basis for instruction.

C. At conclusion of on-site training program have Owner personnel sign written certification they have completed training and understand equipment operation. Include copy of training certificates in final Operation and Maintenance manual submission.

D. Refer to individual equipment specifications for additional training requirements.

END OF SECTION 23 05 00

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes single and three phase motors for application on equipment provided under other sections and for motors furnished loose to Project.

B. General: Provide motors for all equipment. Select for starting torque and starting current suitable for equipment loads and starting equipment. Horsepower rating shown on drawings are required, but motor must not be loaded more than 1.0 x nameplate horsepower. Provide larger motor if required to stay within this limitation and include all costs for any required increases in electrical system.

C. Electrical Characteristics: Provide nameplate ratings same as circuit voltage indicated on electrical drawings. Coordinate to give proper operation with starting equipment scheduled. See Division 26.

1.3 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:

1. NEMA MG 1 – Motors and Generators.

C. All motors furnished shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA, ANSI, IEEE, and ASTM. As a minimum requirement, all motors shall conform to the latest applicable sections of NEMA Standard No. MG-1. Motors must meet or exceed the rebate levels for premium efficiency Motors established by the Consortium for Energy Efficiency (CEE).

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

B. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

C. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Baldor
2. Marathon
3. General Electric
4. Weg
5. A.O. Smith

B. Motors 3/4 hp and Larger: Three-phase motor as specified below.

C. Motors Smaller Than 3/4 hp: Single-phase motor as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.

D. All motors controlled by a Variable Frequency Drive shall be NEMA MG-1 Section 31 Inverter-Fed Rated.

E. Three-phase Motors: NEMA MG-1, Design B, class H premium, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.

1. Service Factor: 1.15

2. Enclosure: Concealed Indoor: ODP, Exposed Indoor: Guarded ODP, Outdoor: Type II TEFC, Outdoor Weather Protected: Type I TEAO.

3. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

4. Insulation System: NEMA Class F.

5. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

6. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for re-lubrication, rated for minimum ABMA 9, L-10 life of 40,000 hours. Calculate bearing loud with NEMA standard shaft extension. Stamp bearing sized on nameplate.

7. Sound Power Levels: Conform to NEMA MG 1.

8. Factory finish starters shall be provided with integral phase failure protection to shut down motor upon loss of an electrical phase and automatically reset upon return of 3 phase power.

F. Single Phase Motors:

1. Permanent split-capacitor type where available, otherwise use split-phase start / capacitor run or capacitor start / capacitor run motor.

2. Service Factor: 1.35.

G. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 SOURCE QUALITY CONTROL

A. General: All motor starters and magnetic contactors are specified in Division 26, except as follows:

1. Starters and motors specified as part of a packaged piece of equipment.

2. Centrifugal chillers which are provided with remote mounted starters under the chiller specification.

3. Variable speed controllers for variable volume air handling units and cooling towers.

B. Provide a tabulation of motors with all pertinent information required for properly rated motor controllers to be provided under Division 26.

C. Provide a tabulation of matched motors and starters provided under Division 23.

D. Variable speed motors controlled by variable frequency drives in general shall be of standard design called out in this specification. The manufacturer shall be notified on the requisition that the motor will be used in conjunction with a variable frequency drive and its type of frequency generation. It shall be the responsibility of the motor manufacturer to ensure that this motor will be capable of operating under the torque requirements and speed range within temperature specifications. The normal speed range shall be 4 to 1 ratio. The motor / drive system shall be capable of maintaining full torque throughout. The motors specified for variable speed application shall be capable of operating at 90 hertz maximum frequency as a minimum requirement but at reduced torque's above 60 HZ.

E. Efficiency: Minimum full load efficiency shall be as follows:

	Open Drip-Proof (ODP)				Totally Enclosed Fan Cooled (TEFC)		
	1200 RPM	**1800 RPM**	**3600 RPM**		**1200 RPM**	**1800 RPM**	**3600 RPM**
HP	**Minimum Efficiency**	**Minimum Efficiency**	**Minimum Efficiency**	**HP**	**Minimum Efficiency**	**Minimum Efficiency**	**Minimum Efficiency**
1	82.5	85.5	77.0	**1**	82.5	85.5	77.0
1.5	86.5	86.5	84.0	**1.5**	87.5	86.5	84.0
2	87.5	86.5	85.5	**2**	88.5	86.5	85.5
3	88.5	89.5	85.5	**3**	89.5	89.5	86.5
5	89.5	89.5	86.5	**5**	89.5	89.5	88.5
7.5	90.2	91.0	88.5	**7.5**	91.0	91.7	89.5
10	91.7	91.7	89.5	**10**	91.0	91.7	90.2
15	91.7	93.0	90.2	**15**	91.7	92.4	91.0
20	92.4	93.0	91.0	**20**	91.7	93.0	91.0
25	93.0	93.6	91.7	**25**	93.0	93.6	91.7
30	93.6	94.1	91.7	**30**	93.0	93.6	91.7

40	94.1	94.1	92.4	**40**	94.1	94.1	92.4
50	94.1	94.5	93.0	**50**	94.1	94.5	93.0
60	94.5	95.0	93.6	**60**	94.5	95.0	93.6
75	94.5	95.0	93.6	**75**	94.5	95.4	93.6
100	95.0	95.4	93.6	**100**	95.0	95.4	94.1
125	95.0	95.4	94.1	**125**	95.0	95.4	95.0
150	95.4	95.8	94.1	**150**	95.8	95.8	95.0
200	95.4	95.8	95.0	**200**	95.8	96.2	95.4

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated in the plans or in the specifications. Contractor's price shall include all items required as per manufacturer's requirements.

3.2 INSTALLATION

A. General: Install in a professional manner. Any part of parts not meeting this requirement shall be replaced or rebuilt without extra expense.

B. Install rotating equipment in static and dynamic balance.

C. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building. Refer to Section 23 05 48.

D. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION 23 05 13

SECTION 23 05 14 - VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. The drive shall be designed specifically for variable torque applications. It is required that the drive manufacturer has an existing independent service organization.

B. The drive and all necessary controls as herein specified shall be supplied by the drive Manufacturer. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of ten (10) years.

C. For Air Handling Units with multiple fans (Fan Array) and motors, VFD manufacturer shall provide internal individual motor overloads to match quantity of fan motors. Refer to Air Handling Unit Schedule for fan motor quantity

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronic Engineers (IEEE)

    a. Standard 519-1992, IEEE Guide for Harmonic Content and Control.

2. Underwriter’s laboratories

    a. UL508C

3. National Electrical Manufacturer’s Association (NEMA)

    a. ICS 7.0, AC Adjustable Speed Drives

4. IEC 16800 Parts 1 and 2

B. Testing:

1. All printed circuit boards shall be completely tested and burned-in before being assembled into the completed VFD. The VFD shall then be subjected to a computerized systems test (cold), burn-in, and computerized systems test (hot). The burn-in shall be at 104 degrees Fahrenheit at full rated load, on a motor. Drive input power shall be continuously cycled for maximum stress and thermal variation.

2. All testing and manufacturing procedures shall be ISO 9001 certified.

C. Failure Analysis:

1. VFD manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray of components, and decap or delaminate of components and analyze failures within the component.

D. Qualifications:

a. VFD's and options shall be UL listed as a complete assembly. VFD's that require the customer to supply external fuses for the VFD to be UL listed are not acceptable.

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Submit VFD's only after coordination with approved Air Handling Units, Pumps, and Cooling Tower Submittals (If applicable).

C. All Variable Frequency Drives serving various equipment such as but not limited to: Air handling Units, Pumps and Cooling towers shall be supplied by the same manufacturer.

D. Submittals shall include, as a minimum, the following information:

1. Outline Dimensions

2. Weight

3. Compliance to IEEE 519 - harmonic analysis for particular job site including total harmonic voltage distortion and total harmonic current distortion.

a. The VFD manufacture shall provide calculations, specific to the installation, showing total harmonic voltage distortion is less than five (5) percent. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519 (latest version), guide for Harmonic Control and Reactive Compensation for Static Power Converters. The acceptance of this calculation must be completed prior VFD installation.

b. If the voltage THD exceeds five (5) percent, the VFD manufacturer is to recommend the additional equipment required to reduce the voltage THD to an acceptable level.

1.5 WARRANTY

A. Warranty shall be (2) two years and shall begin from date of Certificate of Substantial Completion. The warranty shall include all parts, labor, travel time and expenses to provide on-site warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer's original, unopened containers with identification labels intact.

B. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture,

chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

1.7 MANUFACTURERS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. ABB.
2. Yaskawa.
3. Danfoss.

PART 2 - PRODUCTS

2.1 ADJUSTABLE FREQUENCY DRIVES

A. The adjustable frequency drives (VFD's) shall be solid state, with a Pulse Width Modulated (PWM) output. The VFD package as specified herein shall be enclosed in a NEMA 1 enclosure (NEMA 3R if outdoors or unconditioned space), completely assembled and tested by the manufacturer. The VFD shall employ a full wave rectifier (to prevent input line notching), Integral Line Reactor(s), Capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output switching device. The drive efficiency shall be 97 percent or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.

4. Input 480 VAC +/- 10 percent, 3 phase, 48-63 Hz. The overvoltage trip level shall be 30 percent over the nominal, and the under-voltage trip level shall be 35 percent over the nominal voltage as a minimum.

5. Output Frequency 0 to 250 Hz. Operation above 60 Hz shall require programming changes to prevent inadvertent high-speed operation.

6. Environmental operating conditions: 0 to 104 Degree Fahrenheit, 0 to 3300 feet above sea level, less than 95 percent humidity, non-condensing.

7. Conditioned indoors enclosure shall be rated NEMA 1 and shall be UL listed as a plenum rated drive. Drives without this rating are not acceptable.

8. VFD's located in un-conditioned spaces or outdoors shall have rated NEMA 4X enclosure and shall be UL listed as a plenum rated drive. Drives without this rating are not acceptable.

B. All VFD's shall have the following features:

1. All VFD's shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and

menus. The keypad shall be removable, capable of remote mounting, and shall have its own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFD's.

2. The keypad shall include Hand-Off-Auto membrane selections. When in "Hand", the VFD will be started, and the speed will be controlled from the up/down arrows. When in "Off", the VFD will be stopped. When in "Auto", the VFD will start via an external contact closure and the VFD speed will be controlled via an external speed reference. The drive shall incorporate "bump less transfer" of speed reference when switching between "Auto" and "Hand" modes and vice-versa.

3. The VFD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to ACS400-US-reprogram all parameters and customer interfaces for a particular application to reduce programming time.

4. The VFD shall have the ability to automatically restart after an over current, overvoltage, under voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.

5. The VFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start). The VFD shall also be capable of DC injection braking at start to stop a reverse spinning motor prior to ramp.

6. The VFD shall be equipped with an automatic extended control power loss ride-through circuit, which will utilize the inertia of the load to keep the drive powered. Minimum power loss ride-through shall be one-cycle, based on full load and no inertia. Typical control power loss ride-through for a fan load shall be 2 seconds minimum.

7. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.

8. The customer terminal strip shall be isolated from the line and ground.

9. The drive shall employ current limit circuits to provide trip free operation:

    a. The Slow Current Regulation limit circuit shall be adjustable to 150 percent (minimum) of the VFD's normal duty current rating. This adjustment shall be made via the keypad, and shall be displayed in actual amps, and not as percent of full load.

    b. The Current Switch-off limit shall be fixed at 350 percent (minimum, instantaneous) of the VFD's normal duty current rating.

10. The overload rating of the drive shall be 110 percent of its normal duty current rating for one (1) minute in every ten (10) minutes. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-plole motors.

11. The VFD shall have an integral Line Reactor(s) to reduce the harmonics to the power line and to increase the fundamental power factor. The minimum impedance shall be three (3) percent.

12. The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false under load condition.

13. The VFD shall have programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped from the level of a process feedback signal.

14. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection shall be provided in both drive and bypass modes.

15. The following operators shall be provided:

    a. Bypass Hand-Off-Auto

    b. Drive mode selector

    c. Bypass mode selector

    d. Bypass fault reset

16. The following indicating lights (LED type) shall be provided:

    a. Power-on

    b. External fault

    c. Drive mode selected

    d. Bypass mode selected
    e. Drive running

    f. Bypass running

    g. Drive fault

    h. Bypass fault

    i. Automatic transfer to bypass selected

17. Customer Interlock Terminal Strip: Provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes.

18. The following relay (form C) outputs from the bypass shall be provided.

    a. Drive run
    b. Bypass run

c. Drive fault Bypass fault (motor overload or under load (broken belt)

19. Automatic or manual bypass (field selectable)

20. Manual or automatic bypass fault (field selectable)

21. Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure.

22. Door interlocked pad lockable circuit breaker which will disconnect all input power from the drive and all internally mounted options.

23. Fast acting semi-conductor fuses exclusive to the VFD - fast acting semi-conductor fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the Bypass will not be accepted.

24. Class 10 or 20 (selectable) electronic motor overload protection shall be included in the microprocessor bypass to protect the motor in bypass mode.

C. All VFD's to have the following adjustments:

1. Two (2) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed.

2. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The auxiliary power supply shall have overload and over current protection. The PID setpoint shall be adjustable from the VFD keypad, analog inputs, or over the communications bus.

3. Two (2) programmable analog inputs shall accept a current or voltage signal for speed reference or for reference and actual (feedback) signals for PID controller. Analog inputs shall include a filter; programmable from 0.01 to 10 seconds to remove any oscillation in the input signal. The minimum and maximum values (gain and offset) shall be adjustable within the range of 0 - 20 ma and 0 - 10 Volts. Additionally, the reference must be able to be scaled so that maximum reference can represent a frequency less than 60 Hz, without lowering the drive maximum frequency below 60 Hz. Process variables shall be modifiable by math functions such as multiplication and division between the two signals (fan tracking), high/low select, as well as inverted follower.

4. Five (5) programmable digital inputs for maximum flexibility in interfacing with external devices. One digital input is to be utilized as a customer safety connection point for fire, freeze, and smoke interlocks (Enable). Upon remote, customer reset (reclosure of interlock) drive is to resume normal operation.

5. One (1) programmable analog output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.

6. Two (2) programmable digital relay outputs. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; Continuous current rating 2 amps RMS. Outputs

shall be true form C type contacts; open collector outputs are not acceptable. Relays shall be capable of programmable on and off delay times.

7. Seven (7) programmable preset speeds.

8. Two independently adjustable accel and decel ramps. These ramp times shall be adjustable from 1 to 1800 seconds.

9. The VFD shall Ramp or Coast to a stop, as selected by the user.

D. The following operating information displays shall be standard on the VFD digital display. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of two operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Output Frequency

2. Motor Speed (RPM, percent, or Engineering units)

3. Motor Current

4. Calculated Motor Torque

5. Calculated Motor Power (kW)

6. DC Bus Voltage

7. Output Voltage

8. Heat sink Temperature (0°F)

9. Analog Input Values

10. Analog Output Value

11. Keypad Reference Values
12. Elapsed Time Meter (resettable)

13. kWh meter (resettable)

14. mWh meter

15. Digital input status

16. Digital output status

E. The VFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop, and announce the fault condition in complete words (alphanumeric codes are not acceptable).

1. Over current trip 350 percent instantaneous (170 percent RMS) of the VFD's variable torque.

2. Current rating.

3. Overvoltage trip 130 percent of the VFD's rated voltage.

4. Under voltage trip 65 percent of the VFD's rated voltage.

5. Over temperature +90 degrees Celsius.

6. Ground Fault either running or at start.

7. Adaptable Electronic Motor Overload (I 2 t). The Electronic Motor Overload protection hall protects the motor based on speed, load curve, and external fan parameter. Circuits, which are not speed dependant, are unacceptable. The electronic motor overload protection shall be UL approved for this function.

F. Speed Command Input shall be via:

1. Keypad.

2. Two Analog inputs, each capable of accepting a 0-20mA, 4-20mA, 0-10V, 2-10V signal.

3. Floating point input shall accept a three-wire input from a Dwyer Photohelic (or equivalent type) instrument.

4. Serial Communications

G. Serial Communications

1. The VFD shall have an RS-485 port as standard. The standard protocol shall be BACnet. Optional protocols that must be available are Johnson Controls N2 bus, Siemens Building Technologies FLN, LonWorks, Profibus and DeviceNet.

2. Serial communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), percent torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information. Additionally, remote (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored.

3. The VFD shall allow the DDC to control the drive’s digital and analog outputs via the serial interface. The serial communications interface shall allow for DO (relay) control and AO (analog) control. In addition, all drive digital and analog inputs shall be capable of being monitored by the DDC system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive-in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

B. Power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.2 START-UP

A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with drive products offered shall be locally available at both the specifying and installation locations.

END OF SECTION 23 05 14

SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pressure gages.
2. Pressure gage taps.
3. Stem type thermometers.
4. Dial thermometer.
5. Thermometer supports.
6. Test plugs.
7. Bladder-type expansion tanks.
8. Air vents.
9. Combination Dir and Air Separators.
10. Strainers.
11. Flow controls / Balancing Valves.
12. Relief valves.

B. Related Sections:

1. Section 23 21 23 - Hydronic Pumps: Execution requirements for piping connections to products specified by this section.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: Submit for manufactured products and assemblies used in this Project.

1. Manufacturer’s data and list indicating use, operating range, total range, accuracy, and location for manufactured components.

2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.

3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.

4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.

D. Grooved joint couplings and fittings shall be shown on drawings and product submittals and be specifically identified with the applicable Victaulic style or series number.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and instrumentation.

B. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.8 WARRANTY

A. Furnish one (1) year manufacturer warranty for piping specialties.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Weiss
2. Weksler
3. Dwyer

B. Gage: ASME B40.1, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Stainless steel.
2. Bourdon Tube: Phosphor bronze.
3. Dial Size: 4-1/2 diameter.
4. Mid-Scale Accuracy: One (1) percent.
5. Scale: Psi.

2.2 PRESSURE GAGE TAPS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Weiss
2. Pete's Plug

B. Needle Valve: Brass, 1/4-inch NPT for minimum 300 psi.

C. Ball Valve: Brass 1/4-inch NPT for 250 psi.

D. Pulsation Damper: Pressure snubber, brass with 1/4-inch NPT connections.

E. Siphon: Brass, 1/4-inch NPT angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Trerice
2. Weiss

B. Thermometer: Rigid 90°F angle, blue colored, organic, mercury fill, Valox case, brass stem, ½ NPT brass thermowell, acrylic window, lens front, magnifying tube type, scale face of aluminum, white background with black graduations and markings

1. Scale Size: 5-1/2" long.
2. Molded Valox - V-shaped black case.
3. Window: Double Strength Glass
4. Stem: Brass, 1/2-inch NPT, and 2 inches long.
5. Accuracy: ±2% of full scale ASME B40.4 Grade A.
6. Calibration: Both degrees Fahrenheit and degrees Celsius.

2.4 DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Trerice
2. Weiss

B. Thermometer: 300 stainless steel, hermetically sealed, bimetallic, silicone dampened on ranges to 300°F coil, adjustable angle, ½ NPT, double strength glass window, balanced, black finish pointer, dial face of aluminum, white background with black and blue graduations and markings.

1. Dial Size: 5-inch diameter dial.
2. Window: Double strength glass.
3. Stem: 300 Stainless Steel, ¼" diameter NPT, 2-1/2" long.
4. Length of Capillary: Minimum five (5) feet.
5. Accuracy: ±1% of full scale ASME B40.4 Grade A.
6. Calibration: Both degrees Fahrenheit and degrees Celsius.

2.5 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions, and with cap and chain.

B. Flange: Three (3) inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.6 TEST PLUGS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Pete's Plug

B. 1/4-inch NPT or 1/2-inch NPT brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:

1. Neoprene core for temperatures up to 200 degrees F.

C. Provide extended stem to accommodate insulation.

D. Test Kit:

1. Carrying case, internally padded, and fitted containing:

a. One 2-1/2 inch 3-1/2-inch diameter pressure gages.
b. Two gage adapters with 1/8-inch probes.
c. Two 1-1/2-inch dial thermometers.

2.7 BLADDER-TYPE EXPANSION TANKS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Wheatly
2. Bell and Gossett
3. Wessels
4. Armstrong
5. Taco
6. Thrush

B. Tank: Welded steel, rated for maximum 125-psig working pressure and 240 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1. Size: As indicated on Drawings.

C. Bladder: Heavy duty butyl-FDA approved.

D. Gage Glass Set: Brass compression stops, guard, and 3/4-inch red line glass, maximum 24 inches length, long enough to cover tank for two (2) inches above bottom to two (2) inches below top.

E. Quick Connect Air Inlet:

1. Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.

F. Automatic Cold-Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow prevention device, test cocks, strainer, vacuum breaker, and by-pass valves.

G. Hot Water Heating System:

1. Select expansion tank pressure relief valve at 20 psi maximum.
2. Set pressure reduction valve at select 12 psi.

H. Chilled Water System:

1. Select expansion tank pressure relief valve at 25 psi maximum.
2. Set pressure reduction valve at 12 psi.

I. Do not insulate ASME stamp and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

2.8 AIR VENTS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Armstrong
2. ITT
3. Sarco

B. Manual Type: Short vertical sections of two (2) inch diameter pipe to form air chamber, with 1/8-inch brass needle valve at top of chamber.

C. Float Type:

1. Brass, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.

2.9 COMBINATION DIRT AND AIR SEPARATORS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Bell and Gossett
2. Armstrong
3. Wessels
4. Thrush

B. Dip Tube Fitting: For 125 psig operating pressure; to prevent free air collected in boiler from rising into system.

C. Dirt & Air Separator: Each separator must be designed with a blow-down valve, skim valve, and automatic air vent. The separator must also utilize in its design a stainless-steel coalescing medium to aid in the separation of air and dirt in the system entrained water. The separator must be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code and stamped for 125 psi working pressure.

2.10 STRAINERS (GROOVED) – APPLIES TO CHILLERS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Victaulic

B. Size two and a half inch (2-1/2) and Larger:

1. Grooved iron body for 175 psig working pressure, basket pattern with 1/8-inch stainless steel perforated screen.

C. Couplings:

1. Grooved mechanical Installation ready couplings manufactured of a two segment, ASTM A 536, Grade 65-45-12 ductile iron cast housing. Gaskets shall be pressure responsive synthetic rubber, and pre-injected with lubricant, grade EHP or to suit intended service, conforming to ASTM D-2000. Gaskets shall be rated for 250 degrees Fahrenheit and made by grooved manufacturer. Grooved couplings shall be provided “Installation-Ready”; pre-assembled and pushed onto grooved pipe end, joined by second grooved pipe end, and then bolts and nuts are tightened down (no loose parts during installation). Coupling bolts shall be zinc plated heat-treated carbon steel track head conforming to ASTM A-183.

a. Sizes up to 12”: Rigid Type, Style 107; Flexible Type, Style 177.
b. Sizes 14” and larger: Rigid Type, Style W07; Flexible Type, Style W77.

2.11 FLOW CONTROLS / BALANCING VALVES

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. TA / Victaulic

B. 2” and smaller: 300 psi threaded or sweat ends, non-ferrous Ametal® brass copper alloy body, EPDM o-ring seals. 4 turn digital readout hand wheel for balancing, hidden memory feature with locking tamper-proof setting. Victaulic / Tour and Anderson Series balancing valve 787 (threaded) or Series 786 (Sweat). Suitable for operating temperatures to 250°F.

C. Calibration: Factory set to control flow within three (3) percent of design flow over entire operating pressure.

D. Accessories: In-line strainer on inlet and ball valve on outlet.

E. Victaulic coil hookup packages for ½”- 2” shall include a Victaulic/TA valve style 78k; 787 or 786 connection and the following two components: 78U, 78Y. The Victaulic balancing

valve shall be sized to flow, and all components shall be from one manufacturer, Victaulic. Victaulic 78U Union Port Fitting: 1/2" through 2" by Sizes: 400 psi maximum, Sweat/Soldered or FPT threaded x Union ends, DZR forged brass body with manual air vent port and pressure/temperature port, with EPDM seals. Union port fitting shall provide a simplified terminal hookup for installation at coil outlets. Suitable for operating temperatures up to 250°F. Victaulic series 78Y Strainer Ball Valve combination ½" through 2" up to 400psi Ametal copper alloy body consisting of a full port ball valve and strainer with pressure and temperature measuring ports. Ball valve shall be complete with Teflon packing, plated ball, blow-out proof stem, and steel handle with vinyl grip. Strainer shall be Y-pattern, with 20 mesh stainless steel screen and blowdown port.

F. All handles and pressure / sensor ports shall have <u>extended stems</u> to accommodate insulation.

1. Accessories: Test Kit.
2. Carrying case, internally padded, and fitted containing:

    a. One 2-1/2 inch 3-1/2-inch diameter pressure gages.
    b. Two gage adapters with 1/8-inch probes.
    c. Two 1-1/2-inch dial thermometers.

G. Coil Hook up Packages: Victaulic Series 799 including 78u air vent union fittings with extended probe sets with minimum 2" of clearance and 78y strainer/ball valves combination with extended handle and probe set with minimum 2" of clearance. Coordinate with manufacture to confirm insulation clearance. No flex hoses shall be used.

2.12 RELIEF VALVES

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Bell and Gossett
2. McDonnell-Miller
3. Taco

B. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

PART 3 - EXECUTION

3.1 INSTALLATION - THERMOMETERS AND GAGES

A. Install pressure gages for each pump, locate taps before strainers and on suction and discharge of pump, pipe to gage.

B. Install gage taps in piping with isolation valves.

C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

E. Install thermometers in air duct systems on flanges.

F. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

G. Locate duct-mounted thermometers minimum ten (10) feet downstream of mixing-dampers, coils, or other devices causing air turbulence.

H. Coil and conceal excess capillary on remote element instruments.

I. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.

J. Provide instruments with scale ranges selected according to service with largest appropriate scale.

K. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

L. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

A. Locate test plugs adjacent to pressure gages and pressure gage taps and as indicated on Drawings.

B. All Coil Kit valve assemblies shall come equipped with extended stems and extended handle to accommodate pipe insulation. Contractor shall coordinate pipe insulation thickness with coil kit manufacturer prior to ordering valves.

C. Install manual air vents at system high points.

D. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide drain and hose connection with valve on strainer blow down connection.

G. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

I. Support pump fittings with floor mounted pipe and flange supports.

J. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

K. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Equipment relief valve capacity not to exceed rating of connected equipment.

L. Pipe relief valve outlet to nearest floor drain.

M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

N. Insulate all volume tanks to match adjacent intake and discharge piping and jacketing requirements.

END OF SECTION 23 05 19

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Globe valves.
2. Ball valves.
3. Plug valves.
4. Butterfly valves.
5. Swing check valves.
6. Spring loaded check valves.
7. Flanges, unions, and couplings.
8. Vibration Isolation Suction and Discharge Pump Drops.

1.3 SUBMITTALS

A. Product Data: Submit Manufacturers catalog information with valve data and ratings for each service.

B. Welders Certificate: Include welder’s certification of compliance with ASME Section IX.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install valves underground when bedding is wet or frozen.

1.8 WARRANTY

A. Furnish one (1) year manufacturer warranty for valves.

1.9 EXTRA MATERIALS

A. Furnish two (2) packing kits for each size valve.

PART 2 - PRODUCTS

2.1 HEATING AND COOLING VALVES

A. Globe Valves:

1. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

   a. Nibco
   b. Crane
   c. Milwaukee Valve

2. Two (2) inches and Smaller: Construction: Bronze body, bronze trim, union bonnet, rising stem and hand-wheel, inside screw, renewable plug disc and stainless-steel seat ring, solder or threaded ends.

3. Two (2) inches and Larger: Construction: Iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

B. Ball Valves:

1. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

   a. Nibco
   b. Crane
   c. Belimo
   d. Milwaukee Valve

2. Two (2) inches and Smaller: Bronze two-piece body, full port stainless steel ball and stem, Teflon seats and stuffing box ring, lever handle with balancing stops, solder, or threaded ends with union.

3. Two (2) inches and Larger: Cast steel body, stainless steel ball and stem, Teflon seat and stuffing box seals, lever handle, or gear drive hand-wheel for sizes ten (I0) inches and larger, flanged.

4. Where piping is insulated, ball valves shall be equipped with two (2) inch extended handles of non-thermal conductive material. Also provide a protective sleeve to prevent damage to vapor seal when valve adjustment is made. Memory stops shall be adjustable after insulation is applied.

C. Plug Valves:

1. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

a. Nibco
b. Crane

2. Two (2) inches and Smaller: Bronze body, bronze tapered plug, full port opening, non-lubricated, Teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

3. Two (2) inches and Larger: Cast iron body and plug, full port opening, pressure lubricated, Teflon packing, flanged ends. Furnish each plug valve with wrench with setscrew.

D. Butterfly Valves:

1. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

a. Nibco
b. Crane
c. Dezurik
d. Haleson
e. Milwaukee Valve

2. Body: Cast or ductile iron with resilient replaceable EPDM seat, lug ends, extended neck.

3. Disc: Aluminum bronze.

4. Operator: 10 position lever handle on sizes two and half (2 1/2) inches to four (4) inches.

5. Hand-wheel and gear drive on sizes larger than six (6) inches.

E. Butterfly Valves **-** Grooved: **Applies to HVAC pumps, air-cooled chillers and temporary chiller connections; refer to 2.2 of this spec section and Pump and Air-Cooled Chiller Detail.**

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

a. Victaulic

2. Grooved end butterfly valves two (2) inches to twelve (12) inches shall have a ductile iron body, electroless nickel-plated ductile iron disc, blowout proof 416 stainless steel stem, disc shall be offset from stem centerline to provide full 360-degree seating, EPDM seat and seal material, TFE lined fiberglass bearings, lever handle or gear operator with memory stop feature equal to Victaulic Vic-300 MasterSeal.

3. Grooved end butterfly valves fourteen (14) inches to twenty-four (24) inches AGS grooved ends, polyphenylene sulfide (PPS) coated ductile iron body (ASTM A-536, Grade 65-45-12), PPS coated ductile iron disc (ASTM A-536), and two-piece 17-4 PH S/S stem design. Seat and seal material to suit intended service. Reinforced PTFE bearings and gear operator. Bubble tight, dead-end, or bi-directional service. With memory stop for throttling, metering, or balancing service. Victaulic Vic®-300 AGS.

F. Spring Loaded Check Valves (Grooved): **Applies to Pumps and Air-Cooled Chillers; refer to 2.2 of this spec section and Pump and Air-Cooled Chiller Detail.**

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

   a. Victaulic

2. Two and a half (2-1/2) inches to twelve (12) inches: Ductile iron body, aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft, welded-in nickel or synthetic rubber seat with grooved ends equal to Victaulic Series 716.

3. Fourteen (14) inches to twenty-four (24) inches: Ductile iron body, stainless steel dual disc design, EPDM seat bonded to the valve body, 300 series stainless steel spring and shaft, AGS grooved ends equal to Victaulic Series W715.

G. Spring Loaded Check Valves:

1. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

   a. Nibco
   b. Crane
   c. Dezurik
   d. Haleson
   e. Milwaukee Valve

2. Construction: Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer, or threaded lug ends.

3. Two (2) and Smaller: Red bronze body, 301 stainless steel spring-actuated disc, EPDM o-ring, 300 series stainless steel stem and spring, in-line, lift-type check valve.

2.2 VIBRATION ISOLATION SUCTION & DISCHARGE HVAC PUMP DROPS – REQUIRED FOR ALL HVAC PUMPS

A. Manufacturer: Subject to compliance with plans and specification, provide the following:

1. Victaulic.

   a. Victaulic Suction Vibration Isolation Pump drop **model # 381**.

   b. Victaulic Discharge Vibration Isolation Pump drop **model # 380**.

B. Suction Vibration Isolation Pump Drop **Model #381**:

1. Application:

   a. Suction vibration isolation pump drop connects the water flow intake to the pumps.
   b. Provides vibration isolation, noise reduction, expansion, contraction, and deflection.

c. A minimum of (3) three Victaulic flexible couplings are to be utilized to aid in vibration isolation, noise reduction, expansion, contraction, and deflection as shown in detail; a separate pipe vibration isolator is not required.

2. Victaulic Grooved Shut-off Butterfly Valve:

a. Grooved end butterfly valves two (2) inches to twelve (12) inches shall have a ductile iron body, electroless nickel-plated ductile iron disc, blowout proof 416 stainless steel stem, disc shall be offset from stem centerline to provide full 360-degree seating, EPDM seat and seal material, TFE lined fiberglass bearings, lever handle or gear operator with memory stop feature equal to Victaulic Vic-300 MasterSeal.

3. Victaulic Grooved Suction Diffuser:

a. Angle pattern, with flanged outlet and grooved inlet connections.

b. 175-psig pressure rating, ductile-iron body and end cap, pump-inlet fitting.

c. 20 mesh stainless steel, type 304 fine mesh startup pre-filter and 5/32” perforated type 304 stainless-steel permanent strainers.

d. Stainless-steel straightening guide vanes.

e. Drain plug, blow-down tapping in bottom, gage tapping on side.

f. Factory-fabricated adjustable foot support.

g. Provide bosses on either side for pressure measurement.

h. Permanent magnet located in flow stream removable for cleaning.

C. Discharge Vibration Isolation Pump Drop **Model #380**:

1. Application:

a. Discharge vibration isolation pump drop connects the pump to the interconnecting pipe / discharge header within the mechanical rooms.

b. Provides noise reduction, expansion, contraction, and deflection.

c. A minimum of (3) three Victaulic flexible couplings are to be utilized to aid in vibration isolation, noise reduction, expansion, contraction, and deflection as shown in detail; a separate pipe vibration isolator is not required.

2. Victaulic Grooved 90° Elbow Fitting:

a. Two (2”) - Twelve (12”) DN50 – DN300.
b. Fitting Material: Ductile iron conforming to ASTM A536, Grade 65-45-12.
c. Maximum Working Pressure: 400 psi.
d. Coating: Orange.

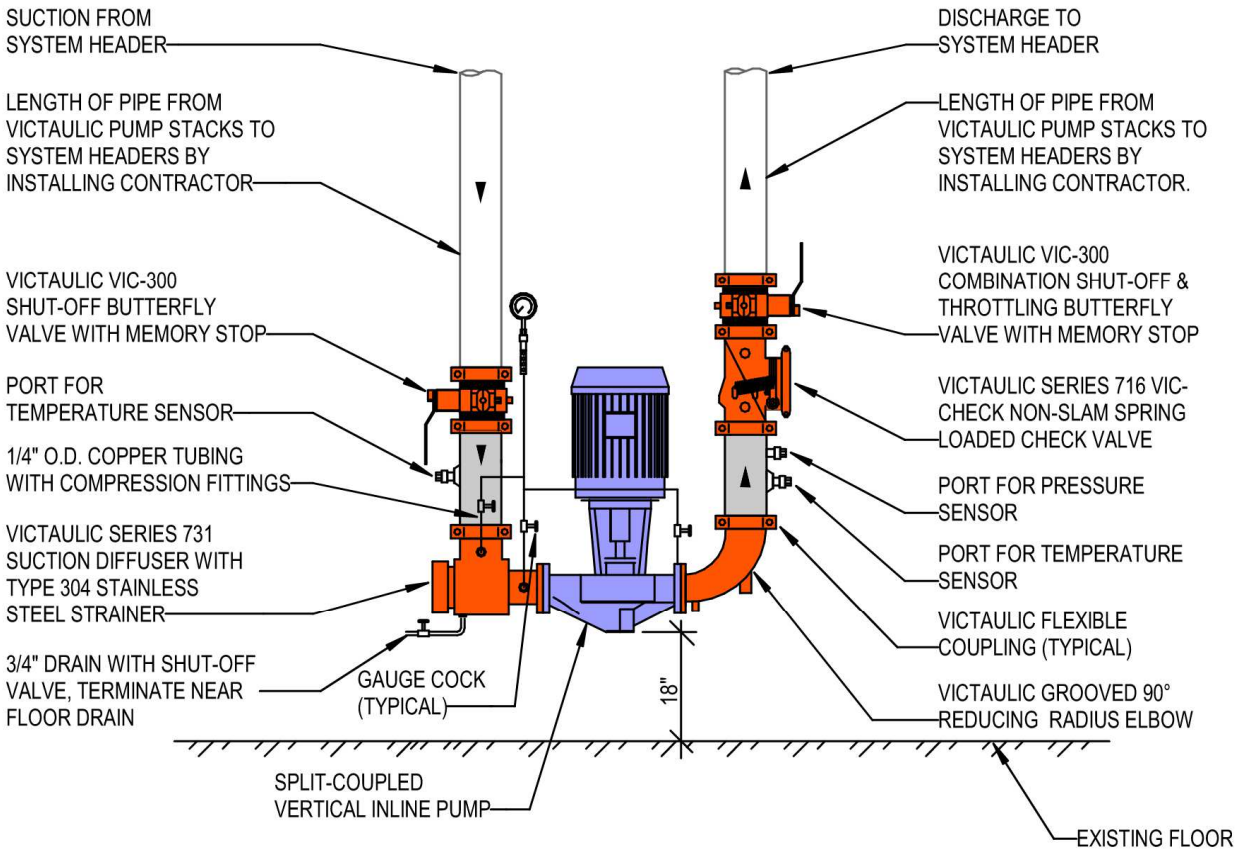
3. Victaulic Grooved Non-Slam Spring Loaded Check Valve:

a. Two and a half (2-1/2) inches to twelve (12) inches: Ductile iron body, aluminum bronze or elastomer encapsulated ductile iron disc, stainless steel spring and shaft, welded-in nickel, or synthetic rubber seat with grooved ends equal to Victaulic Series 716.

4. Victaulic Grooved Shut-off Butterfly Valve:

a. Grooved end butterfly valves two (2) inches to twelve (12) inches shall have a ductile iron body, electroless nickel-plated ductile iron disc, blowout proof 416 stainless steel stem, disc shall be offset from stem centerline to provide full 360-degree seating, EPDM seat and seal material, TFE lined fiberglass bearings, lever handle or gear operator with memory stop feature equal to Victaulic Vic-300 MasterSeal.

b. Grooved end butterfly valves fourteen (14) inches to twenty-four (24) inches AGS grooved ends, polyphenylene sulfide (PPS) coated ductile iron body (ASTM A-536, Grade 65-45-12), PPS coated ductile iron disc (ASTM A-536), and two-piece 17-4 PH S/S stem design. Seat and seal material to suit intended service. Reinforced PTFE bearings and gear operator. Bubble tight, dead-end, or bi-directional service. With memory stop for throttling, metering, or balancing service. Victaulic Vic®-300 AGS.



CONTRACTOR SHALL DETERMINE FINAL LENGTH OF SUCTION AND DISCHARGE PIPING TO NEW PIPING HEADERS.

2.3 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe two (2) inches and Smaller:

1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze soldered or push-to-connect joints.

B. Flanges for Pipe two (2) inches and Larger:

1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Copper Piping: Bronze.

C. Gaskets: 1/16-inch-thick preformed neoprene.

D. Grooved Joint Flange Adapters two (2) inches and Larger:

1. Ductile iron housing for use with grooved end pipe and fittings, flat face, for direct connection to flanges with ANSI Class 125 and 150 bolt hole patterns equal to Victaulic Style 741. For direct connection to flanges with ANSI Class 300 bolt hole pattern, use Victaulic Style 743.

E. Grooved Pipe End Couplings:

1. Housing: Two-piece ductile iron housing conforming to ASTM A-536, Grade 65-45-12.

2. Gasket: Synthetic rubber conforming to steel pipe outside diameter and coupling housing, manufactured of elastomers as designated in ASTM D-2000. operating temperature range from -30 degrees Fahrenheit to 250 degrees Fahrenheit.

3. Rigid type couplings shall have angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9 equal to Victaulic Style 107V.

4. Flexible type couplings shall be used where vibration attenuation and stress relief are required, equal to Victaulic Style 177.

F. Accessories: Stainless Steel bolts, nuts, and washers.

G. Dielectric Connections:

1. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2. Waterway fitting with zinc electroplated steel or ductile iron body, threaded or plain end, water impervious isolation barrier.

3. Waterway fitting with zinc electroplated steel or ductile iron body, threaded or plain end, water impervious isolation barrier.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide non-conducting dielectric connections wherever joining dissimilar metals.

B. Install valves with stems upright or horizontal, not inverted.

C. Use grooved mechanical couplings where approved by the engineer.

D. Install butterfly or ball shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

E. Install calibrated-orifice, balancing valves at each branch connection to return main.

F. Install globe or ball valves for throttling, bypass, or manual flow control services.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide flow controls in water re-circulating systems.

I. Use only butterfly valves in chilled and condenser water systems for throttling and isolation service.

J. Use 1 1/4” inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

K. Install valves in accessible locations to permit removal of bonnet.

L. Install valve stems in vertical position. Valve stems installed in horizontal position shall be no less than 30 degrees from horizontal.

M. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved joint couplings and valves shall be supplied by a single manufacturer. The gasket style and elastomeric material shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove. A Victaulic factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

1. Install the grooved joint piping system in accordance with the latest manufacturer installation instructions. Pipe ends shall be clean and free from indentations and projections. Use manufacturer grooving tools with roll sets to groove the pipe. Follow manufacturer guidelines for tool selection and operation. Products shall not be installed with standard grooved end pipe or components. Installing products in combination with standard grooved end products could result in joint separation and/or leakage.

END OF SECTION 23 05 23

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Equipment roof curbs and support rails.
6. Sleeves.
7. Mechanical sleeve seals.
8. Formed steel channel and angle.
9. Equipment bases and supports.
10. Portable roof pipe supports.

B. Related Sections:

1. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

2. Division 7 - Thermal and Moisture Protection.

1.3 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show fabrication and installation details and include calculations for the following: include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather, construction traffic, dirt, water, chemical, and mechanical damage.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply Firestopping materials when temperature of substrate material and ambient air is below 60 degrees Fahrenheit.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of Firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

1.8 WARRANTY

A. Furnish one (1) year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Carpenter & Paterson Inc.
2. Flex-Weld, Inc.
3. Globe Pipe Hanger Products Inc.
4. Michigan Hanger Co.
5. B-Line Systems
6. Carpenter & Patterson Inc.
7. Anvil International
8. Piping Technology & Products
9. Grinnell

B. Hydronic Piping:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

2. Hangers for Cold Pipe Sizes two (2) inches and larger: Carbon steel, adjustable, clevis.

3. Hangers for Hot Pipe Sizes 2 inches to 4 inches: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes six (6) inches and larger: Adjustable steel yoke, cast iron roll, double hanger.

5. Multiple or Trapeze Hangers: Galvanized Steel channels with welded spacers and hanger rods.

6. Multiple or Trapeze Hangers for Hot Pipe Sizes six (6) inches and larger: Galvanized Steel channels with welded spacers and hanger rods, cast iron rollers.

7. Wall Support for Pipe Sizes three (3) inches and smaller: Cast iron hooks.

8. Wall Support for Pipe Sizes four (4) inches and larger: Welded galvanized steel bracket and wrought steel clamp.

9. Wall Support for Hot Pipe Sizes six (6) inches and larger: Welded galvanized steel bracket and wrought steel clamp with adjustable steel yoke and cast-iron roll.

10. Vertical Support: galvanized Steel riser clamp.

11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

12. Floor Support for Hot Pipe Sizes four (4) Inches and smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

13. Floor Support for Hot Pipe Sizes six (6) inches and larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

14. Copper Pipe Support: Copper-plated, carbon steel ring.

15. Hydronic Piping shall not have support brackets welded to hydronic piping.

C. Roof Mounted Hydronic Piping:

1. Refer to Division 7 –for hanger requirements and approved manufacturers.

2.2 HANGER RODS

A. Hanger Rods: Hot dipped galvanized, mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. In accordance with Division 7 - Thermal and Moisture Protection.

2.5 HOODED CURB

A. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24-gauge stainless steel.

2.6 EQUIPMENT ROOF CURBS AND SUPPORT RAILS

A. Equipment roof curbs and support rails must be coordinated with roof type specified under Division 7.

B. Roof mounted exhaust fans, intake hoods, relief hoods and supply fans shall be set on equipment manufacturers 12” high fabricated welded 18-gauge galvanized steel shell and base, mitered three (3) inch cant if required by roofing type, variable step to match roof insulation, 1-1/2-inch-thick curb insulation, factory installed treated wood nailer. Curb shall set level on roof without the need for blocking.

C. Roof mounted unitary air conditioning units shall be set on a structural type of curb or equipment support rail. Curb or support rail shall be compatible with required vibration isolation specified under Section 23 05 48. Curb or support rail shall be 12” high welded 18-gauge galvanized steel shell and base, mitered three (3) inch cant if required by roofing type, variable step to match roof insulation, 1-1/2-inch-thick insulation, 3 lb. density, factory installed wood nailer and stainless-steel cap. Curb shall set level on roof without the need for blocking. Field bolted curbs are not acceptable.

D. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

   a. The Pate Co.
   b. Custom Curb, Inc.
   c. Roof Products, Inc.

E. Refer to Division 7 - Thermal and Moisture Protection for additional requirements.

2.7 SLEEVES

A. Sleeves for Pipes through fire rated or non-fire rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Rated or Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel.

E. Sealant: Refer to Section 07 92 00 - Building Sealants.

2.8 MECHANICAL SLEEVE SEALS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.9 FORMED STEEL CHANNEL AND ANGLE

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.

B. Product Description: Galvanized 14 gage thick steel angle and galvanized 12 gage thick steel channel with holes 1-1/2 inches on center. Metal framing system for equipment support.

C. All channel members and angles shall be hot-dipped galvanized and fabricated from structural grade steel and conform to applicable ASTM specifications.

D. Structural members to be loaded within manufacturers design limitations and published data.

2.10 EQUIPMENT BASES AND SUPPORTS

A. In accordance with Division 3 – Concrete

B. Provide concrete equipment pads, reinforced with 6-inch x 6-inch welded wire mesh, chamfered edges and to be six (6) inches larger than base of equipment. Pad heights as follows:

1. Hot Water Boilers: four (4) inches.
2. Floor Mounted Pumps: four (4) inches.
3. Floor Mounted Water Volume Tanks: four (4) inches.
4. Air Handling Units: four (4) inches.
5. Water Heaters: four (4) inches.
6. Water Softeners: four (4) inches.
7. Air Compressor: four (4) inches.
8. Floor Mounted Expansion Tanks: four (4) inches.
9. Floor Mounted chemical feeder tanks: four (4) inches.
10. Floor Mounted Fans: four (4) inches.
11. Chillers: four (4) inches.
12. Condensing Units: four (4) inches.
13. Heat Pump Units: four (4) inches.
14. Dust Collectors: four (4) inches.
15. Plasma cutters: four (4) inches.

C. Provide vibration isolation in accordance with Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

2.11 PORTABLE ROOF PIPE SUPPORTS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Advanced Support Products (ASP)
2. PHP System Design

B. Steel and PVC Piping: Provide rooftop portable pipe supports in 8'-0" maximum intervals for steel, 4'-0" maximum intervals for PVC piping. Roof supports shall be manufactured by Advanced Support Products (ASP), model SS6000P with height adjustable crossbar and clevis hangers. Product specifications:

1. Support Base: 17" circular base, injected molded polypropylene, with 227 sq. in. of surface on bottom, designed for weight displacement.

2. Base Dimensions: 3"H x 17" in diameter, designed for weight displacement, with molded insert for square tubing and two threaded rod couplings molded in.

3. Height: Adjustable.

4. Frame: 1-5/8" x 1-5/8" 12-gauge channel (ASTM A653), hot- dipped galvanized.

5. Hardware: Corner brackets and leg brackets bolted with ½" x 2-1/2" bolt & ½" nut; frame bolted to support base with ½" x 2-1/2" bolts, ½" nuts and washers. Leg brackets and all thread rods, nuts and washers shall be hot- dipped galvanized.

6. Required accessories: ½" threaded rod, clevis hangers, strut clamps and protection pads.

C. Condensate disposal piping: Provide rooftop portable pipe supports in 8'-0" maximum intervals for steel condensate piping. Roof supports shall be manufactured by Advanced Support Products (ASP), model REC-SA (Rubber EcoCurb) with channel. Product specifications:

1. Bases: 100% recycled Vulcanized Rubber with UV inhibitors.

2. Frame: 1-5/8" x 1-5/8" 12-gauge channel (ASTM A653), hot- dipped galvanized.

3. Hardware: ½" threaded rods (12" high); ½" nuts & washers, hot- dipped galvanized.

4. Height: Adjustable.

5. Required accessories: Strut clamps and protection pads.

6. Hot dipped galvanized threaded rods, nuts and washers.

D. Protection pads: Provide protection pad sheets between the roof / grade and support system. Protection pads shall not be adhered to either the roof or the support system.

1. Material: Porous rubber.
2. Weight: 2 lbs.
3. Dimensions: 18" square X ½" thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive Firestopping/Firesafing.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of Firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Do not drill or cut structural members.

F. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 STRUCTURAL STEEL

A. All structural steel used to fabricate supports shall conform to ASTM A36.

3.4 CUTTING AND PATCHING

A. In accordance with Division 7 - Thermal and Moisture Protection

3.5 FIRESTOPPING

A. In accordance with Division 7 - Thermal and Moisture Protection.

3.6 FIRESTOPPING ACCESSORIES

A. In accordance with Division 7 - Thermal and Moisture Protection.

3.7 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe four (4) inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.8 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2-inch minimum vertical adjustment.

F. Support vertical piping at every other floor.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports.

L. Provide clearance in hangers and from structure and other equipment for installation of pipe insulation. Refer to Section 23 07 19 - HVAC Piping Insulation.

3.9 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum four (4) inches thick and extending six (6) inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.10 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for mechanical roof installations 12 inches minimum above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

C. Adjust storm collars tight to pipe with bolts, caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

D. Refer to Division 7 - Thermal and Moisture Protection for additional requirements.

3.11 INSTALLATION - SLEEVES

A. Provide sleeves at all piping and ductwork penetrations of interior walls and slabs. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors two (2) inches above finished floor level. Caulk sleeves.

E. Extend sleeves through walls two (2) inches each side.

F. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with Firestopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install stainless steel escutcheons at finished surfaces.

3.12 INSTALLATION - FIRESTOPPING

A. Install material at all fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items.

B. Apply primer where recommended by manufacturer for type of Firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply Firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Fire Rated Surface:

1. Seal opening at floor, wall, and partition as follows:

    a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.

    b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.

    c. Pack void with backing material.

    d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

F. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall and partition floor as follows:

    a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.

b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.

2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.13 INSTALLATION - ACCESS DOORS

A. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts, and other apparatus where concealed. Access doors shall have concealed hinges and screwdriver cam locks. Minimum size to be 12 inches x 12 inches in walls only for hand access and 24 inches x 24 inches minimum for all ceilings for maintenance access.

B. All access doors located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

C. Access Doors:

1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect and with trim styles and color coordinated with surface to be installed in.

3.14 INSTALLATION – EQUIPMENT REQUIRING ROOF PORTALBE BASES

A. Verify that roof surface is smooth and clean to extent needed to receive material.

B. Clean surfaces to receive 17” circular bases removing any loose gravel and foreign matter before setting 17” circular bases.

C. Provide protective pad conforming to the new or existing roof manufacturer’s system under each 17” circular bases. Do not adhere to the roof system or to circular bases.

3.15 FIELD QUALITY CONTROL

A. Inspect installed Firestopping for compliance with specifications and submitted schedule.

3.16 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.17 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.18 PIPE HANGERS

A. Minimum hanger rod size shall be ½".

B. Maximum hanger rod spacing shall not exceed 10'-0" on center for pipe sizes 2" and above. Do not exceed 7'-0" hanger spacing for pipes sizes less than 2" diameter.

C. For trapeze supports provide a minimum of (2) two ½" hanger rods at each end of trapeze for a total of (4) four for pipes 10" or larger.

D. Beam clamps are not acceptable.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Vibration isolation for building mechanical systems.

B. Related Sections:

1. Section - 23 05 16 - Expansion Fittings and Loops For HVAC Piping
2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

C. Mason Industries model numbers are listed for identification only.

D. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Mason Industries
2. Kinetics Noise Control
3. Amber / Booth
4. VMC
5. Vibration Eliminator

1.3 PERFORMANCE REQUIREMENTS

A. It is the intent of this specification to provide vibration isolation supports for all equipment, piping and ductwork as may be required to prevent transmission of vibration to the building structure. It will be the Contractor's responsibility to select and install vibration isolators which will enable the noise criteria standards to be met, to the extent that the noise can be controlled by the vibration isolators.

B. All vibration isolation devices, including auxiliary steel bases and pouring forms, shall be designed and furnished by a single manufacturer or supplier.

C. Unless otherwise noted or scheduled, spring type vibration isolators shall be used for all equipment driven by motors of 0.5 HP and larger. Deflections as tabulated are minimums and it shall be the responsibility of the isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance in order to prevent the transmission of objectionable vibrations and meet the noise criteria referenced herein.

D. Unless otherwise noted, equipment driven by motors 0.25 HP and smaller shall be isolated by means of Type ND elastomeric mounts or Type HD elastomeric hangers properly sized for 0.35-inch deflection.

E. All elastomeric isolators shall be of high-quality synthetic rubber with anti-ozone and anti-oxidant additives.

F. Design and treat vibration isolators for resistance to corrosion. Furnish phosphatized steel components with epoxy powder paint coating. Components exposed to the weather

shall be epoxy powder paint coated or hot-dipped galvanized. Furnish zinc electroplated nuts, bolts, and washers. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

G. Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind loads of 30 lbs/sq.ft. Wind loading shall be applied to all exposed surface of the isolated equipment in order to identify worst case load.

H. Air handling equipment subjected to excessive horizontal air thrust operating at three (3) inches S.P. shall be furnished with Type WBI/WBD isolated thrust resisters to limit displacement to 1/4 inch.

I. Height savings brackets used with isolators having 2.5-inch deflection or greater shall be of the precompression type to limit exposed bolt length.

J. All spring isolators shall be completely stable in operation and shall be designed for not less than 50 percent reserve deflection beyond actual operating conditions. All spring isolators must be completely stable in operation and have a Kx/Ky ratio of at least 1:1.

K. All isolation materials and flexible connectors shall be of the same manufacturer and shall be selected and certified using published or factory certified data. Any variance or non-compliance with these specification requirements shall be corrected by the contractor at no additional cost to the Owner. Manufacturer may purchase other manufactured products in order to meet this specification and shall guarantee outsourced product as a single point of responsibility. Outsourced products must be identified as such in the submittal for approval.

L. The contractor and manufacturer of the isolation and equipment shall refer to the isolator schedule which lists isolator types and isolator deflections.

M. Deflection table is based on maintaining rooms at the following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE and ANSI S1.8.

1. Offices
   Executive: 30
   Conference rooms: 30
   Private: 35
   Open-plan areas: 35
   Computer/business machine areas: 40
   Public circulation: 40

2. Schools
   Lecture and classrooms: 30
   Open-plan classrooms: 35

3. Libraries: 25

4. Theaters
   Theater: 25
   Stage house: 25
   Trap room: 25
   Orchestra pit: 25
   Rehearsal rooms: 25
   Teaching studios: 30
   Practice rooms: 30

Ensemble rooms: 30
Shop: 45

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, and layout as well as connection details.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating materials and dimensional data. All steel bases and concrete inertia bases shall be completely detailed. Include clearly outlined procedures for installing and adjusting the isolators.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

F. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate vibration isolation installation is complete and in accordance with instructions. Provide a copy of field report to Architect/Engineer.

1.5 QUALITY ASSURANCE

A. The vibration isolation manufacturer, or qualified representative, shall be responsible for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Vibration isolation manufacturer shall also inspect vibration isolation in units with factory provided isolation in order to confirm scheduled deflection and isolator type is in accordance with this specification. Upon completion of the installation and after the system is put into operation, the manufacturer, or representative, shall make a final inspection, and submit his report to the Architect and Engineer in writing certifying the correctness of installation and compliance is in accordance approved submittal data.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATOR TYPES

All vibration isolators described in this section shall be the product of a single manufacturer. Submittals and certification sheets shall be in accordance with Specification 1.3 of this section.

A. Type WSW: Two layers of 3/8-inch thick neoprene pad consisting of square waffle modules separated horizontally by a 16-gauge galvanized shim. Where the load bearing area of the equipment is not the same size/shape as the load bearing area/shape of the pad, load distribution plates, minimum ¼” thick galvanized steel, shall be utilized to

ensure the load bearing capacity of the pad is maximized. Pads shall be sized for approximate deflection of 0.12 inch to 0.16 inch.

B. Type ND: Neoprene mountings shall have minimum static deflection of 0.35 inch. All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes on the bottom and a tapped hole with a mounting bolt and washer shall be provided. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang. Where the load bearing area of the equipment or support structure is not the same size/shape as the load bearing area/shape of the pad, load distribution plates, minimum ¼" thick galvanized steel, shall be utilized to ensure the load bearing capacity of the pad is maximized.

C. Type SLF: Spring isolators shall be free-standing and laterally stable without any housing and complete with a steel-washer-reinforced molded neoprene cup of 1/4-inch neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have minimum additional travel to solid equal to 50 percent of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.

D. Type SLR: Restrained spring mountings shall have an SLF mounting as described in Specification 2.1 C, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2 inch shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position under outdoor equipment, there must be an internal isolation pad in addition to the friction pad on bottom.

E. Type HD: Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch-thick neoprene element. The neoprene element shall have neoprene bushings projecting through the steel box. In order to maintain stability, the boxes shall not be articulated as clevis hangers.

F. Type 30N: Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch-thick neoprene elements at the top and a steel spring as described in 2.1 C, seated in a steel-washer-reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability, the boxes shall not be articulated as clevis hangers, nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

G. Type PC30N: Hangers shall be as described in Specification 2.1 F, but they shall be precompressed and locked at the rated deflection by means of a resilient seismic up stop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30-degree capability.

H. Type WBI/WBD: Horizontal thrust restraints shall consist of a spring element in series with a neoprene molded cup, as described in paragraph 2.1 C, with the same deflection

as specified for the mountings or hangers supporting the unit. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4-inch movement at start and stop. The assembly shall be furnished with a rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Isolators shall be installed as recommended by the manufacturer. Isolate all mechanical equipment 0.5 hp and over per the isolation schedule and these specifications.

3.2 PIPING ISOLATION

A. Horizontal Pipe Isolation: All pumped water, pumped condensate, and refrigerant piping size 1-1/4 inch and larger within mechanical rooms and on pipe size 2 inch and larger outside mechanical rooms shall be isolated. Outside equipment rooms this piping shall be isolated for the greater of 50 feet or 100 pipe diameters from externally isolated equipment. For the first 3 support locations from externally isolated equipment provide Type 30N hangers or Type SLF floor mounts with the same deflection as equipment isolators. All other piping within the equipment rooms shall be isolated with the same specification isolators with a 1” inch minimum deflection. Install piping hangers at regular intervals according to the pipe hanger schedule. Where floor supports are required, provide sufficient spring capacity to absorb expansion and contraction of piping, and yet to permit piping to function as a floating system. Size hangers for 200 percent rated load. Coordinate selection of piping supports with equipment supports to accommodate expansion and contraction without creating excessive stresses at equipment connections.

B. Pipe Riser Isolation: All vertical pipe risers 1-1/4 inch and larger, where specifically shown and detailed on riser drawings shall be fully supported by Type SW SLF isolators with brackets. Refer to details on Drawings. Steel spring deflection shall be 3/4 inch minimum. In locations where added deflection is required due to pipe expansion/contraction, the spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the riser in tension. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Provide Type SWS wall sleeves. In addition to submittal data requirements previously outlined, riser diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the piping system has been examined for excessive stresses and that none will exist in the design proposed.

3.3 INSTALLATION

A. Comply with manufacturer’s instructions for the installation and load application of vibration isolation materials and products. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation or shipment.

B. Locate isolation hangers as near the overhead support structure as possible.

C. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.

D. Install isolated inertia base frames and steel bases on isolator units as indicated so that a minimum of one (1) inch clearance below base will result when supported equipment has been installed and loaded for operation.

E. Install Work in accordance with ASME B31.9.

F. Install flexible pipe connectors to equipment supported by vibration isolation. Provide line size flexible connectors.

G. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.

H. Refer to Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

I. Contractor shall install load distribution plates provided by vibration isolation manufacturer on WSW type isolators. Plates shall be aligned with isolation pad.

EQUIPMENT ISOLATION SCHEDULE

EQUIPMENT	LOCATION					
	ELEVATED STRUCTURE			SLAB ON GRADE		
	ISOLATOR TYPE	MINIMUM DEFLECTION (Inches)	BASE (1) TYPE	ISOLATOR TYPE	MINIMUM DEFLECTION (Inches)	BASE (1) TYPE
AIR HANDLING UNITS (NOTE 2)						
FLOOR MOUNTED	SLF	0.75	-	SLF	0.75	-
TO 15 HP	SLF	1.5	-	SLF	0.75	-
20 HP & OVER						
SUSPENDED	30N	1	-	30N	1	-
UP TO 15 HP	PC30N	1.75	-	PC30N	1	-
20 HP & OVER						
HIGH PRESSURE FAN SECTION (NOTE 1)	SLF/WBI	1.5	RBMK	SLF/WBI	0.75	RBMK
UP TO 30 HP	SLF/WBI	2.5	RBMK	SLF/WBI	1.5	RBMK
40 HP & OVER						
CENTRIFUGAL FANS						
CL. I & II UP TO 54-1/2" W.D.						
Up to 15 HP	SLF	0.75	WF	SLF	0.75	WF
20-50 HP	SLF	1.5	RBMK	SLF	0.75	WF
60 HP & OVER	SLF	2.5	RBMK	SLF	1.5	WF
CL. I & II 60" W.D. & OVER/ALL						
CL. III FANS UP TO 15 HP	SLF/WBI	1.5	RBMK	SLF/WBI	0.75	RBMK
20-50 HP	SLF/WBI	2.5	RBMK	SLF/WBI	1.5	RBMK
60 HP & OVER	SLF/WBI	2.5	RBMK	SLF/WBI	1.5	RBMK

AXIAL-FLOW FANS (NOTE 1)						
FLOOR MTD.						
UP TO 15 HP	SLF	0.75	-	SLF	0.75	-
20 HP & OVER	SLF	1.5	-	SLF	0.75	-
SUSPENDED (NOTE 1)						
UP TO 15 HO	30N	1	-	30N	1	-
20 HP & OVER	PC30N	1.75	WF	PC30N	1.5	-
VENT (UTILITY SETS)						
FLOOR MTD.	SLF	0.75	-	SLF	0.75	-
SUSPENDED	30N	1	-	30N	0.75	-
CABINET FANS, FAN SECTIONS (NOTE 1)						
CL. I & II UP TO 54-1/2" W.D.	SLF	0.75	-	SLF	0.75	-
Up to 15 HP	SLF	1.5	-	SLF	0.75	-
20-50 HP						
SUSPENDED	30N	1	-	30N	0.75	-
UP TO 15 HP	PC30N	1.75	-	30N	1.75	-
20 HP & OVER						
PUMPS						
FLOOR MTD. UP TO 60 HP	SLF	1.50	RBMK	SLF	0.75	RBMK
FLOOR MTD. 75 HP AND LARGER	SLF	2.50	RBMK	SLF	0.75	RBMK
SUSPENDED INLINE	PC30N	1.75	-	PC30N	1.75	-
REFRIGERATION UNITS						
RECIPROCATING	SLF	1.5	RBMK	SLF	0.75	RBMK
COMPRSSORS	SLR/IC	1.5	-	SLF	0.75	-
RECIPROCATING COND.	S	1.5	-	WSW	0.15	-
UNITS & CHILLERS	SLR	1.5	RBMK	WSW	0.15	-
HERMETIC	SLF	0.75	-	WSW	0.15	-
CENTRIFUGALS	SLR/IC					
OPEN CENTRIFUGALS	S					
ABSORPTION MACHINES						
AIR COMPRESSORS						
TANK TYPE (HORIZONTAL	SLF	1.5	-	SLF	0.75	-
TANK)	SLF	1.5	-	SLF	0.75	-
TANK TYPE (VERTICAL TANK)						
COOLING TOWERS &						
CLOSED-CIRCUIT COOLERS	SLR	0.75	(1)	WSW	0.15	-
UP TO 500 TONS	SLR	2.5	(1)	WSW	0.15	-
OVER 500 TONS						
AIR COOLED CONDENSERS						
UP TO 50 TONS	SLR	0.75	(1)	WSW	0.15	-
OVER 50 TONS	SLR	1.5	(1)	WSW	0.15	-
ROOFTOP AIR CONDITIONING UNITS						
REQUIRING WEATHER	SLF	0.75	RSC/C	-	-	-
SEAL	SLR	1.5	MAB	-	-	-
UP TO 5000 CFM (12 TON)			RSC/C			
OVER 5000 CFM (12 TON)	SLR	1.5	MAB	-	-	-
OTHER TYPES	SLR	1.5		-	-	-
UP TO 25 TONS			(1)			
OVER 25 TONS			(1)			

BOILER (PACKAGE TYPE) ALL SIZES	SLR	0.75		WSW	0.15	-
ENGINE DRIVEN GENERATORS UP TO 60 HP 75 HO & OVER	SLR SLR	1.5 2.5	RBMK RBMK	SLR SLR	0.75 0.75	- -

Notes:

1. Provide steel base type WF if equipment requires base frame or does not include integral base rail for vibration isolation.

2. Provide WSW isolator type with load distribution plate for floor mounted AHU's that are internally isolated. Isolation deflection and type specified refers to factory isolation requirements.

END OF SECTION 23 05 48

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.
8. Pipe painting (if required)

B. Related Sections:

1. Section 09 91 00 - Painting and Staining.

C. Color scheme for identification must be coordinated with district standards. Color scheme specified is bases of design if required for project. Contractor shall confirm painting requirements with Architect/District.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.
2. District Standards for identification and color scheme.

1.4 SUBMITTALS

A. Product Data: Submit manufacturers catalog literature for each product required.

B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Identify painting requirements as directed by Architect/District. Contractor to confirm if painting of piping is required for project. Contractor shall provide primer coat on un-insulated outdoor condenser water piping as a minimum.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Conform to ANSI / OSHA Pipe Marking Specifications.

C. Specification is not limited to manufacturers listed. Substitutions are allowed in accordance with Division 1 - General Requirements and Division 23, Section 23 05 00 - Common Work Results for HVAC.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Almetek Industries.
5. Marking Services, INC. (MSI).

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

a. Craftmark Identification Systems.
b. Safety Sign Co.
c. Seton Identification Products.
d. Almetek Industries.
e. Marking Services, INC. (MSI).

2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches.

B. Metal Tags:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

    a. Craftmark Identification Systems.
    b. Safety Sign Co.
    c. Seton Identification Products.
    d. Almetek Industries.
    e. Marking Services, INC. (MSI).

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

    a. Craftmark Identification Systems.
    b. Safety Sign Co.
    c. Seton Identification Products.
    d. Almetek Industries.
    e. Marking Services, INC. (MSI).

2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in plastic laminated chart to indicate valve make, size, model, and service.

2.3 STENCILS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Almetek Industries.
5. Marking Services, INC. (MSI).

B. Stencils: With clean cut symbols and letters of following size:

1. Up to two (2) inches Outside Diameter of Insulation or Pipe: 1/2-inch-high letters.

2. 2-1/2 to six (6) inches Outside Diameter of Insulation or Pipe: one (1) inch high letters.

3. Over six (6) inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.

4. Ductwork and Equipment: 1-3/4 inches high letters.

C. Stencil Paint: As specified in Section 09 91 00 Paintings and Staining, semi-gloss enamel, colors, and lettering size in conformance with ASME A13.1.

2.4 PIPE MARKERS

A. Plastic Pipe Markers:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

    a. Craftmark Identification Systems.
    b. Safety Sign Co.
    c. Seton Identification Products.
    d. Almetek Industries.
    e. Marking Services, INC. (MSI).

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

B. Plastic Tape Pipe Markers:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

    a. Craftmark Identification Systems.
    b. Safety Sign Co.
    c. Seton Identification Products.
    d. Almetek Industries.
    e. Marking Services, INC. (MSI).

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Underground Pipe Markers:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

    a. Craftmark Identification Systems.
    b. Safety Sign Co.
    c. Seton Identification Products.
    d. Almetek Industries.
    e. Marking Services, INC. (MSI).

2. Bright colored continuously printed plastic ribbon tape, minimum six (6) inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Almetek Industries.
5. Marking Services, INC. (MSI).

B. Description: Steel with 3/4-inch diameter color-coded head.

2.6 LABELS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Almetek Industries.
5. Marking Services, INC. (MSI).

B. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

a. Craftmark Identification Systems.
b. Safety Sign Co.
c. Seton Identification Products.
d. Almetek Industries.
e. Marking Services, INC. (MSI).

2. Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

a. Craftmark Identification Systems.
b. Safety Sign Co.
c. Seton Identification Products.
d. Almetek Industries.
e. Marking Services, INC. (MSI).

2. Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 91 00 Paintings and Staining for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Section 09 91 00 Paintings and Staining.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain or 4 ply 0.018 smooth copper wire. Tags shall be numerically sequenced with all valves of each system type grouped together.

F. Install underground plastic pipe markers six (6) to eight (8) inches below finished grade, directly above buried pipe.

G. All exterior visible piping shall be identified with UV and acid resistant outdoor pipe markers.

H. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

I. Identify control panels and major control components outside panels with plastic nameplates.

J. Identify air terminal units and radiator valves with numbered tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify insulated piping, concealed, or exposed indoor with plastic tape pipe markers. Use tags on piping 3/4-inch diameter and smaller. Use plastic pipe UV protected markers on exterior piping. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification at every 20 feet on center for straight runs including risers and drops. Locate identification adjacent to each valve and tee, at each side of penetration of wall or enclosure, and at each obstruction.

M. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment. Coordinate with Architect.

N. Identify un-insulated piping with plastic pipe markers. Locate identification at every 20 feet on center for straight runs including risers and drops. Locate identification adjacent to each valve and tee, at each side of penetration of wall or enclosure, and at each obstruction.

3.3 IDENTIFICATION SCHEDULE

A. Markers shall be colored as indicated below per ANSI/OSHA Standards OR as specified in District Standards:

SYSTEM	COLOR	LEGEND
Chilled Water	Green	Chilled Water Supply Chilled Water Return
Domestic Water	Green	Domestic Water
Domestic Hot Water Supply	Yellow	Domestic Hot Water Supply

Domestic Hot Water Return	Yellow	Domestic Hot Water Return
Fire Protection	Red	Fire Protection
Automatic Sprinkler	Red	Fire Sprinkler
Gas	Safety Yellow	Natural Gas
Condenser Water	Light Green	Condenser Water Supply
	Dark Green	Condenser Water Return

B. PIPE PAINTING:

1. All piping exposed to view in conditioned and unconditioned spaces shall be epoxy painted as indicated or as directed by the Architect in the field. Confirm all color selections and painting requirements with Architect/District prior to installation.

2. The entire fire protection piping system shall be painted red.

3. All outdoor un-insulated piping shall be painted with primer as a minimum.

4. All piping located in mechanical rooms and outdoor piping shall be epoxy painted as indicated in Painting Schedule. Painting requirement must be confirmed by contractor.

5. Contractor shall provide a framed copy of the chart below and hang within the central plant for Maintenance Personnel.

C. PAINTING SCHEDULE

SYSTEM	COLOR
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange
Condenser Water Supply	Light Green (SW-4069)
Condenser Water Return	Dark Green (SW-4071)
Natural Gas	Safety Yellow (SW-4084)
Chilled Water Supply and Return	Light Blue
Heating Hot Water supply and Return	Reddish Orange

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Testing, adjusting, and balancing of air systems.
2. Testing, adjusting, and balancing of Hydronic piping systems
3. Testing, adjusting, and balancing of refrigerating systems.
4. Measurement of final operating condition of HVAC systems.
5. Sound measurement of equipment operating conditions.
6. Vibration measurement of equipment operating conditions.

B. Related Sections:

1. Sequences of operation for HVAC equipment as scheduled on Drawings.

C. Testing, Adjusting and Balancing (TAB) contractor shall bid work specified under this section direct to Owner. TAB contractor shall not be hired by general contractor or any sub-contractor.

D. Mechanical contractor is responsible for coordinating work with the TAB Contractor. Mechanical contractor requirements are specified herein.

E. TAB Contractors:

1. Engineered Air Balance
2. Precision Air

1.3 REFERENCES

A. Associated Air Balance Council:

1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:

1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.4 SUBMITTALS

A. Agency Data: Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technicians Data: Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting and balancing procedures and agenda proposed to be used for this project.

D. Sample Forms: Submit sample forms, if other than those standard forms, if other than those standard forms prepared by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) are proposed.

E. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of hoe the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft Reports: Upon completion of testing, adjusting and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit two (2) complete sets of draft reports. Only one (1) complete set of draft reports will be returned.

2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit two (2) complete sets of final reports.

3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binder. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs.

    a. General Information and Summary
    b. Air Systems
    c. Refrigerant Systems
    d. Temperature Control Systems
    e. Special Systems.

4. Report Contents: Provide the following minimum information, forms and data:

    a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, the Company, Engineer, and Project. Include addresses and contact names and telephone numbers. Also include a certification sheet containing the seal name address, telephone

number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.

b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC or NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

c. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six (6) months prior to starting the project.

1.5 QUALITY ASSURANCE

A. Test and Balance Engineer's Qualifications: A Professional Engineers registered in the State in which the services are to be performed and having at least three (3) years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications:

1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to the test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and recording and reporting the results.

2. The independent testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) or by the Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by NEBB or AABC as a Test and Balance Engineer.

C. Codes and Standards

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

2. AABC: "National Standards for Total System Balance."

3. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) ASHRAE Handbook, 1999 HVAC Applications Volume, Chapter 36, Testing, Adjusting, and Balancing.

D. Pre-Balancing Conference: Prior to beginning of testing, adjusting, and balancing procedures, schedule and conduct a conference with the Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of the system operation and readiness for testing, adjusting, and balancing.

1.6 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.7 SEQUENCING AND SCHEDULING

A. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.

B. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within five (5) degrees Fahrenheit wet bulb temperature of maximum summer design condition, and within ten (10) degrees Fahrenheit dry bulb temperature of minimum winter design condition. Take final temperature reading during seasonal operation.

C. Notice: Provide minimum 7 days advanced notice for each test. Include scheduled test dates and times.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 SERVICES OF THE MECHANICAL CONTRACTOR

A. Examine the contract documents to become familiar with Project requirements and to discover conditions in systems design that may preclude proper TAB of systems and equipment.

B. Examine the approved submittals for HVAC systems and equipment.

C. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed, and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balancing valves are open.
16. Re-sheave

D. Contractor shall provide all volume dampers, balancing dampers, balancing valves, test ports and Pete's plugs as required by the Testing and Balancing Firm. Contractor shall furnish a set of sheet metal shop drawings and HVAC piping drawings to the Testing and Balancing Firm during the submittal phase and incorporate the Testing and Balancing Firm's mark-ups and requests into the project. Contractor shall provide all required equipment to facilitate Testing and Balancing Firm's work. This coordination shall be included in the Contractor's base bid price.

E. Provide, correct, repair or replace deficient items or conditions found during the testing and balancing.

F. Provide replacement sheaves as directed by TAB Contractor to achieve scheduled air volumes.

G. For motors with a variable frequency drive, contractor shall provide belt and sheave adjustment such that units deliver their design cfm when speed drive is at 60 hertz.

3.2 SERVICES OF THE TESTING AND BALANCING CONTRACTOR

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

C. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 INSTALLATION TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust fans and Equipment with Fans: +/- 5%

2. Air Outlets and Inlets: +/- 5%

3. Heating-Water Flow Rate: +/- 5%

4. Cooling-Water Flow Rate: +/- 5%

3.4 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries in clean rooms.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from construction manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.
a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR DUAL-DUCT SYSTEMS

A. Verify that the cooling coil is capable of full-system airflow and set mixing boxes at full-cold airflow position for fan volume.

B. Measure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.

1. If insufficient static pressure exists, increase airflow at the fan.

C. Test and adjust the constant-volume mixing boxes as follows:

1. Verify both hot and cold operations by adjusting the thermostat and observing changes in air temperature and volume.

2. Verify sufficient inlet static pressure before making volume adjustments.

3. Adjust mixing boxes to indicated airflows within specified tolerances. Measure airflow by Pitot-tube traverse readings or by measuring static pressure at mixing-box taps if provided by mixing-box manufacturer.

D. Do not over pressurize ducts.

E. Re-measure static pressure in both hot and cold ducts at the end of the longest duct run to determine that sufficient static pressure exists to operate controls of mixing boxes and to overcome resistance in the ducts and outlets downstream from mixing boxes.

F. Adjust variable-air-volume, dual-duct systems in the same way as constant-volume, dual-duct systems; adjust maximum- and minimum-airflow setting of each mixing box.

3.8 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at minimum set-

point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    b. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

8. Record final fan-performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance variable-air-volume systems the same as described for constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.

3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

4. Readjust fan airflow for final maximum readings.

5. Measure operating static pressure at the sensor that controls the supply fan if one is installed and verify operation of the static-pressure controller.

6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.

7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.

3. Set terminal units at full-airflow condition.

4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Adjust terminal units for minimum airflow.

6. Measure static pressure at the sensor.

7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.9 PROCEDURES FOR MULTIZONE SYSTEMS

A. Set unit at maximum airflow through the cooling coil.

B. Adjust each zone's balancing damper to achieve indicated airflow within the zone.

3.10 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.

2. Check liquid level in expansion tank.

3. Check makeup water-station pressure gage for adequate pressure for highest vent.

4. Check flow-control valves for specified sequence of operation and set at indicated flow.

5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.

6. Set system controls so automatic valves are wide open to heat exchangers.

7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.11 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

   a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Owner/Engineer and comply with requirements in "Hydronic Pump Specification."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

   a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated pre-settings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.

2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.

3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.12 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.13 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first and then balance the secondary circuits.

3.14 PROCEDURES FOR DOMESTIC HOT WATER SYSTEMS

A. The test and balance contractor shall provide testing, adjusting and balancing of the hot water system, once the system is fully installed and operational. Preliminary and final reports shall be prepared and issued to the General Contractor, Architect and Engineer.

B. Preparation of the hot water system for balancing:

1. Confirm outlet temperature of the system at water heaters and/or storage tanks.

2. Verify recirculation pump operation and rotation.

3. Confirm/adjust setpoint of each individual riser balancing valve to flow a minimum of 0.5 gpm or as otherwise noted on the documents.

C. The test and balance report shall indicate the following:

1. Pressure, temperature and flow in gpm at the discharge side of each balancing valve referencing the valve tag number.

2. Pressure, temperature and flow in gpm at the suction side of each circulating pump.

3.15 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Measure inlet steam pressure.

E. Check settings and operation of safety and relief valves. Record settings.

3.16 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.17 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.

2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.

3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.

4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.

5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.

6. Capacity: Calculate in tons of cooling.

7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.18 PROCEDURES FOR COOLING TOWERS

A. A complete Factory CTI certified test of the cooling tower will be performed at the expense of the cooling tower manufacturer. A copy of this test (provided by others) shall be included in the final TAB report. Balance the flow over and through bypass connections of the tower.

3.19 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.20 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.21 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.

2. Measure motor voltage and amperage. Compare the values to motor nameplate information.

3. Check the refrigerant charge.

4. Check the condition of filters.

5. Check the condition of coils.

6. Check the operation of the drain pan and condensate-drain trap.

7. Check bearings and other lubricated parts for proper lubrication.

8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan speed and the face velocity of filters and coils.

2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.

4. Balance each air outlet.

3.22 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.

15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.

5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches, and bore.
   i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   j. Number, make, and size of belts.
   k. Number, type, and size of filters.

2. Motor Data:

   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

   a. Total air flow rate in cfm (L/s).
   b. Total system static pressure in inches wg (Pa).
   c. Fan rpm.
   d. Discharge static pressure in inches wg (Pa).
   e. Filter static-pressure differential in inches wg (Pa).
   f. Preheat-coil static-pressure differential in inches wg (Pa).
   g. Cooling-coil static-pressure differential in inches wg (Pa).
   h. Heating-coil static-pressure differential in inches wg (Pa).
   i. Outdoor airflow in cfm (L/s).
   j. Return airflow in cfm (L/s).
   k. Outdoor-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

F. Apparatus-Coil Test Reports:
1. Coil Data:

   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.

f. Make and model number.
g. Face area in sq. ft
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Entering-water temperature in deg F (deg C).
k. Leaving-water temperature in deg F (deg C).
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig (kPa).
n. Refrigerant suction temperature in deg F (deg C).
o. Inlet steam pressure in psig (kPa).

G. Gas Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h (kW).
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg (Pa).
f. Leaving-air static pressure in inches wg (Pa).
g. Air static-pressure differential in inches wg (Pa).
h. Low-fire fuel input in Btu/h (kW).

i. High-fire fuel input in Btu/h (kW).
j. Manifold pressure in psig (kPa).
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h (kW).
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h (kW).

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h (kW).
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in sq. ft.
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h (kW).
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig (Pa).

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

    a. System and air-handling-unit identification.
    b. Location and zone.
    c. Room or riser served.
    d. Coil make and size.
    e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm (L/s).
    b. Entering-water temperature in deg F.
    c. Leaving-water temperature in deg F.
    d. Water pressure drop in feet of head or psig (kPa).
    e. Entering-air temperature in deg F.
    f. Leaving-air temperature in deg F.

M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and size.
    e. Model number and serial number.
    f. Water flow rate in gpm.
    g. Water pressure differential in feet of head or psig (kPa).
    h. Required net positive suction head in feet of head or psig (kPa).
    i. Pump rpm.
    j. Impeller diameter in inches.
    k. Motor make and frame size.
    l. Motor horsepower and rpm.
    m. Voltage at each connection.
    n. Amperage for each phase.
    o. Full-load amperage and service factor.
    p. Seal type.

2. Test Data (Indicated and Actual Values):

    a. Static head in feet of head or psig (kPa).
    b. Pump shutoff pressure in feet of head or psig (kPa).
    c. Actual impeller size in inches.
    d. Full-open flow rate in gpm.
    e. Full-open pressure in feet of head or psig (kPa).
    f. Final discharge pressure in feet of head or psig (kPa).
    g. Final suction pressure in feet of head or psig (kPa).
    h. Final total pressure in feet of head or psig (kPa).
    i. Final water flow rate in gpm.
    j. Voltage at each connection.
    k. Amperage for each phase.

N. Vibration Test:

1. Location of points:

    a. Fan bearing, drive end
    b. Fan bearing, opposite end
    c. Motor bearing, center (when applicable)
    d. Motor bearing, drive end
    e. Motor bearing, opposite end
    f. Casing (bottom or top)
    g. Casing (side)
    h. Duct after flexible connection (discharge)
    i. Duct after flexible connection (suction)

2. Test readings:

    a. Horizontal, velocity and displacement
    b. Vertical, velocity and displacement
    c. Axial, velocity and displacement
    d. Normally acceptable readings, velocity and acceleration
    e. Unusual conditions at time of test
    f. Vibration source (when non-complying)

O. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.
    b. Serial number.
    c. Application.
    d. Dates of use.
    e. Dates of calibration.

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCT INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

B. Section Includes: Insulation systems for sheet metal duct conveying cold, hot, and grease laden air.

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Provide duct insulation systems which have been manufactured, fabricated, and installed to meet all thermal requirements of mechanical systems. Insulating systems shall be installed in strict accordance with manufacturer's field requirements and the current International Energy Conservation Code including all local amendments and criteria specified herein.

B. Performance Requirements: Provide duct insulation systems which have been manufactured and installed to meet the following standards:

C.

1. NFPA 90A.
2. NFPA 90B.
3. UL 723, ASTM E84: Flamespread 25, smoke developed 50.
4. ASTM C1136: 150 degrees F.
5. ASTM C1290.
6. UL 181 for Class I Air Duct.
7. NAIMA AHS-152T.

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. When manufacturer's cut sheets apply to a product series rather than a specific product, clearly indicate applicable data by **highlighting** or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show specific pertinent performance data and quantities appropriate to scope of work

C. Submit manufacturer's product data and installation instructions.

D. Provide drawings indicating typical duct insulation details, thickness and location. Identify areas and required insulation.

E. Manufacturer's certificate that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer who has demonstrated five (5) years experience on projects of similar size and complexity.

B. Condensation on any insulated system is not acceptable. Contractor shall replace insulation deemed unacceptable due to exposure to condensation at no additional cost to project.

C. Insulation to provide minimum R-value in accordance with current International Energy Conservation Code including all local amendments and criteria specified herein.

1.6 DELIVERY, STORAGE & HANDLING

A. Deliver insulation materials in manufacturer's original, unopened containers with identification labels intact.

B. Contractor shall adequately protect insulation from damage after delivery to the project. Materials shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver materials to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – MUST BE MANUFACTURED AND BRANDED BY ONE OF THE FOLLOWING:

A. Fiber Glass Insulation: Subject to compliance with plans and specification, provide one of the following:

1. Owens Corning
2. Johns Manville
3. CertainTeed
4. Knauf brand Insulation

B. Mastics and Adhesive: Subject to compliance with plans and specification, provide one of the following:

1. Childers
2. Foster
3. Vimasco

C. Fiberglass Reinforcing Cloth Mesh: Subject to compliance with plans and specification, provide one of the following:

1. Perma Glass
2. Alpha Glass
3. Childers
4. Vimasco

D. Fire Wrap Insulation: Subject to compliance with plans and specification, provide one of the following:

1. 3M Fire Barrier Duct Wrap
2. Vesuvius Pyroscat Duct Wrap
3. Unifrax Corporation

2.2 DUCT WRAP

A. Material: Resilient blanket of fiberglass insulation factory laminated to foil/kraft vapor retarder facing.

B. Density: 0.75 pounds per cubic foot.

C. Installed minimum R value: 6.0.

D. Nominal Thickness: 2-3/16 inches.

E. Installed Thickness: 1-5/8 inches.

F. Installed Thermal Conductivity (compressed): k = 0.27

G. Operating Temperature (ASTM C411): up to 250° Fahrenheit.

H. Insulation Jacket Temperature Limit (ASTM C1136): up to 150° Fahrenheit.

I. Water Vapor Sorption (ASTM C1104): < 3 percent by weight at 120° Fahrenheit, 95% RH.

J. Testing Method 1338: Fungi Resistance Comply with requirements.

K. ASTM 665 Mineral Fiber Thermal Insulation: Comply with requirements.

L. Surface Burning Characteristics (ASTM E84): Flame spread 25, smoke developed 50.

2.3 ACOUSTICAL FLEXIBLE DUCT LINER:

A. Material: Acoustical insulation applied to interior of sheet metal ducts. Semi-rigid board of glass fibers with a tough, fire-resistant, anti-microbial, acrylic coating on the airstream side. Factory applied edge coating. Duct liner for rectangular and round duct as required.

A. Density: 1.5 pounds per cubic foot.

B. Installed minimum R value: 6.3.

C. Thickness: 1-1/2 inches.

D. Thermal Conductivity k, (ASTM C518): 0.24

E. Acoustic Performance: Sound absorption coefficients at octave band center frequencies (Hz)

Freq. (Hz)	125	250	500	1K	2K	4K	NRC
TL (dB)	0.19	0.55	0.84	1.0	1.0	.98	.85

F. Material Standards: Comply with NFPA 90A, NFPA 90B, and ASTM C1071.

G. Operating Temperature (ASTM C411): 250 degrees Fahrenheit.

H. Maximum Air Velocity (UL 181 Erosion test ASTM C1071): 6,000 fpm.

I. Water Vapor Sorption (ASTM C1104): < 3 percent by weight at 120°F, 95% RH.

J. Fungi Resistance (ASTM C1338 & G21): Comply with requirements.

K. Bacteria Resistance (ASTM G22): Comply with requirements.

L. Corrosiveness (ASTM C665): Will not cause corrosion greater than that caused by sterile cotton on aluminum or steel.

M. Surface Burning Characteristics (ASTM E84, UL 723): Flame spread 25, smoke developed 50.

2.4 GREASE EXHAUST DUCT

A. 1-1/2-inch-thick refractory ceramic blanket or calcia, magnesia and silica with aluminum foil, fiberglass-reinforced scrim encapsulation.

B. Product to be UL Listed as a two (2) hour duct enclosure.

C. Product shall be tested in accordance with the following:

1. ASTM G 411
2. ASTM C 51
3. ASTM E 84
4. ASTM E 119
5. ASTM E 136
6. ASTM E 814
7. UL 1978 Sections 12 and B

2.5 ACCESSORIES

A. Pressure-Sensitivity Aluminum Foil Tapes:

1. Material Standard: Listed and labeled under UL 181A, Part I, identified by name, date of manufacture, product name/number and UL 181A.
2. Size: At least 2-1/2 inches wide.

B. Heat-Activated Tapes:

1. Material Standard: Listed and labeled under UL 181A, Part II, identified by name, date of manufacture, product name/number and UL 181A, may be used in all applications except for bonding to sheet metal.

2. Size: At least three (3) inches wide.

C. Mastic and Glass Fabric System:

a. Material Standard: Listed and labeled under UL 181A, Part III.
b. Size: At least three (3) inches wide.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the duct insulation manufacturer.

3.2 INSTALLATION

A. ACOUSTICAL LINING OF SHEET METAL DUCT AND FITTINGS:

1. Completely cover all portions of duct designated to receive duct liner with duct liner material. Neatly butt all transverse joints with no interruptions or gaps. The black pigmented or mat faced surface of the duct liner shall face the airstream.

2. Affix duct liner to the sheet metal with 90 percent coverage of adhesive complying with the requirements of ASTM C916. All exposed leading edges and transverse joints shall be factory coated or coated with adhesive during fabrication.

3. Secure duct liner with mechanical fasteners, either weld-secured or impact-driven. Compress the duct liner sufficiently to hold it firmly in place. Adhesive bonded pins are not permitted. Space mechanical fasteners with respect to duct liner interior width as follows:

    a. Maximum spacing for mechanical fasteners where air velocity is 0 – 2,500 FPM is as follows:

        1. From transverse end of liner: three (3) inches.
        2. Across width of duct: 12 inches on center.
        3. From corners of duct: four (4) inches.
        4. Along length of duct: 18 inches on center.

    b. Maximum spacing for mechanical fasteners where air velocity is 2,501 – 5,000 FPM is as follows:

        1. From transverse end of liner: three (3) inches.
        2. Across width of duct: six (6) inches on center.
        3. From corners of duct: four (4) inches.
        4. Along length of duct: 16 inches on center.

4. Provide galvanized metal clips on all leading edges of duct liner. Exposed insulation is not acceptable.

5. Cut duct liner to ensure overlapped and compressed longitudinal corner joints.

6. Cut duct liner board to ensure tight, overlapped corner joints. Support the top pieces of liner board at the edges by the side pieces.

7. If the specification requires use of multiple insulation layers, take the following additional steps:

    a. Affix bottom layer of duct liner in normal manner.

    b. Affix top layer of duct liner to bottom layer using a minimum of 90% adhesive coverage.

c. Treat the leading edges of the duct liner with galvanized angle clips to prevent separation of the 2 layers.

d. Use mechanical fasteners of the proper length for the double layer.

8. Application: Provide duct liner as follows:

a. Provide duct liner in first 10 feet of duct from roof mounted exhaust fans.
b. Provide duct liner in all return air boots and transfer ducts.
c. Provide duct liner in the first 20 feet of supply and return duct from roof mounted air handling units / roof top units.

B. THERMAL INSUALTION WRAP ON DUCT AND FITTINGS:

1. Before applying duct wrap, air ducts must be clean, dry, and tightly sealed at all joints and seams.

2. All portions of duct designated to receive duct wrap shall be completely covered with duct wrap.

3. To ensure installed thermal performance, duct wrap insulation shall be cut to “stretch-out” dimensions as shown in tables in manufacturer’s literature.

4. Remove a two (2) inch piece of insulation from the facing at the end of the piece of duct wrap to form an overlapping stapling and taping flap.

5. Install duct wrap insulation with facing outside so that the tape flap overlaps the insulation and facing at the other end of the piece of duct wrap. Adjacent sections of duct wrap insulation shall be tightly butted with the two (2) inch stapling and taping flap overlapping. On rectangular duct, install so insulation is not excessively compressed at corners. Staple seams approximately six (6) inches on center with 1/2-inch minimum steel outward clinching staples.

6. Seal seams and joints with glass fabric and mastic. Do not use cloth duct tape of any color or finish using reclaimed rubber adhesives on duct wrap insulation. Tightly butt adjacent sections of duct wrap with the two (2) inch tape flap overlapping.

7. Where rectangular ducts are 24 inches in width or greater, additionally secure duct wrap insulation to the bottom of the duct with mechanical fasteners such as pins and speed clip washers or cuphead weld pins, spaced on 18-inch centers (maximum) to prevent sagging of insulation. Do not overly compress insulation.

8. Seal all tears, punctures and other penetrations of the duct wrap facing using glass fabric and mastic.

9. Application: Provide duct wrap as follows:

a. All supply duct

b. All outside air supply and intake duct

c. All return air duct

d. All return air plenums on air units

e. All intake plenums on outside air handling units

f. All ductwork routed in un-conditioned spaces including but not limited to un-conditioned plenums (non-return air plenums), attics, exterior soffits, ventilated mechanical/boiler rooms and crawl spaces.

C. GREASE EXHAUST DUCT AND FITTINGS:

1. Provide one (1) or two (2) layers of Ductwrap to create a 2-hour rated duct enclosure. Each layer shall be lapped a minimum of three (3) inches. Inner layer shall be held in place with one (1) inch wide filament tape, spaced 1-1/2 inch from edges and midway at 10-1-2 centers. The outer layer shall be offset by 10-1/2 inches of inner layer, and one (1) inch wide filament tape shall be used in same manner as inner layer. 1/2-inch x 0.015-inch carbon steel banding strips on shall be installed same dimensions as tape to secure both layers on duct. All horizontal and vertical support hangers shall be wrapped with 1-layer of fire rated duct wrap and be secured with stainless steel ties or 1/2-inch hose clamps.

2. Access Door Installation: Four galvanized steel threaded rods, 1/4-inch diameter by 5 inches long are to be welded to the duct at the corners of the door opening. Four steel tubes, each 3 inches long, are placed over the rods to act as protection for the duct wrap when fastening the door. Four insulation pins are to be welded to the door panel for installation of the blanket. One layer of duct wrap is cut approximately the same size as the access panel and impaled over the insulation pins on the panel. It is essential that this layer fit tightly against the wrap surrounding the access door opening with no through openings. A second layer of duct wrap is cut to overlap the first layer by a minimum of one (1) inch. The second layer is impaled over the pins and both layers are locked in place with galvanized speed clips. Pins that extend beyond the outer layer of duct wrap shall be turned down to avoid sharp points. The insulated door panel is placed over the threaded rods and held in place with washers and wing nuts. Provide an access door at each change in duct direction and a minimum of every 10 feet on straight duct.

3. Filament tape can be used to temporarily hold the blanket in place until the banding is applied. The steel banding is applied around the duct 1-1/2 inch from edge of the blanket, and maximum 10-1/2-inch centers. The banding is placed around the material and tightened so as to sufficiently hold the duct wrap in place against the duct, compressing the foil but not cutting the foil.

4. Additional Pinning to Prevent Sagging of Wrap: For ducts 24 inches and larger in width, additional pins are needed to support the blanket on the bottom horizontal surface and on the outside face of a vertical duct run. Space pins a maximum of 10-1/2 inches apart in the direction of the blanket width, and a maximum of 12 inches apart in the direction of the blanket length.

5. Provide 12 ga copper-coated steel insulation pins with 1.5-inch square or round cup-head pins. Insulation pins are to be welded to ducts.

6. Duct Support Systems: Provide one layer of insulation to cover support components. Maintain 3-inch overlap.

7. Application:

   a. Provide 2-hour enclosure on grease exhaust duct. Enclosure shall extend from kitchen hood to underside of roof deck.

D. EXTERIOR OR INTERIOR EXPOSED DUCT

1. Duct shall be galvanized double wall insulated round or rectangular with perforated liner. Insulation shall be acrylic coated to prevent biological growth and airside erosion. Provide 2", 2.0 pcf insulation on exterior duct (installed R-value of 8.0) and 1-1/2", 1.5 pcf (installed R-Value of 6.0) on interior exposed duct. Duct and fittings shall use a bolted flange with neoprene gasket at each connection. Provide factory seal at flange and duct. Visual sealant on exposed interior duct to be painted is unacceptable.

2. Round duct to be galvanized spiral lockseam type.

3. Exposed round duct shall utilize single rod hangers with angle support rings. Double rod hangers are only acceptable on concealed duct.

4. Application: Provide double wall duct as follows:

   a. Gymnasiums
   b. Natatoriums
   c. Return air plenums with ducted connection to return grilles
   d. Ducted connections to return air grilles
   e. Any area where ductwork is exposed

3.3 FIELD QUALITY CONTROL

A. Inspection: Upon completion of installation of the duct system and before operation is to commence, visually inspect the system and verify that it has been correctly installed.

B. Contractor shall inspect systems during test and balance to ensure that the formation of condensation is not present. Contractor shall be responsible for damage caused by condensation.

3.4 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site.

3.5 INSULATION SCHEDULE

A. Supply and return ducts routed indoors (Ambient temperature $\leq$ 85 degrees Fahrenheit, RH $\leq$ 70 percent): R-6.0 (minimum).

B. Supply, return, and exhaust ducts routed in unconditioned spaces including but not limited to: un-conditioned plenums (non-return air plenums), attics, exterior soffits, mechanical/boiler rooms and crawl spaces. (Ambient temperature $\leq$ 95 degrees Fahrenheit, RH $\leq$ 70 percent): R-6.0 (minimum).

C. Supply, return, and exhaust ducts routed outdoors or in spaces where temperature and relative humidity exceed that specified for unconditioned spaces: R-8.3 (minimum).

D. R-values represent installed values.

E. Provide multiple layers of insulation or thicker insulation to achieve R-values listed. If multiple layers are utilized, inner insulation layer shall not include vapor retarder.

END OF SECTION 23 07 13

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.1 SUMMARY

A. Section Includes:

1. Chilled Water Components
2. Heating Hot Water Components

1.2 SYSTEM DESCRIPTION

A. Provide equipment insulation systems that have been manufactured, fabricated, and installed to meet the current International Energy Conservation Code and all local amendments and criteria specified herein.

B. Performance Requirements: Provide equipment insulation systems which have been manufactured, fabricated, and installed to meet the following criteria:

1. NFPA 90A Installation of Air Conditioning and Ventilation Systems.
2. NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. When manufacturer's cut sheets apply to a product series rather than a specific product, clearly indicate applicable data by **highlighting** or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show specific pertinent performance data and quantities appropriate to scope of work

C. Submit manufacturer’s product data and installation instructions.

D. Provide drawings indicating typical duct insulation details, thickness, and location. Identify areas and required insulation.

E. Manufacturer’s certificate that products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated five (5) years experience on projects of similar size and complexity.

B. Condensation on any insulated system is not acceptable. Replace insulation damaged by condensation.

C. Insulation to provide minimum R-Value in accordance with International Energy Conservation Code with Houston Amendment.

D. Certifications: Manufacturer certification that products supplied meet or exceed specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation materials in manufacturer's original, unopened containers with identification labels intact.

B. Contractor shall adequately protect insulation from damage after delivery to the project. Materials shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver materials to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass Fiber Pipe Insulation: Subject to compliance with plans and specification, provide one of the following:

1. Johns Manville
2. Owens-Corning
3. Knauf
4. Certainteed

B. Cellular Glass Insulation: Subject to compliance with plans and specification, provide one of the following:

1. Pittsburg Corning
2. Cell-U-Form

C. Aluminum Jacketing: Subject to compliance with plans and specification, provide one of the following:

1. Perma Glass Mesh
2. Alpha Glass Mesh
3. Childers Chil-Glas
4. Vimasco
5. RPR Products Inc.

D. Mastics and Adhesives: Subject to compliance with plans and specification, provide one of the following:

1. Childers
2. Foster
3. Vimasco

2.2 EQUIPMENT INSULATION

A. Glass Fiber Insulation Boards:

1. Thickness: Same thickness as connected piping.

2. Equipment Operating Temperature Limit (ASTM C411): Up to 450 degrees Fahrenheit.

3. Insulation Jacket Temperature Limit (ASTM C1136): -20 - 150 degrees Fahrenheit.

4. Vapor Retarder: ASJ vapor retarder facing.

5. Jacket Permeance (ASTM E96): 0.02 perm.

6. Jacket Puncture Resistance (ASTM D781): ASJ: 50 units.

7. Water Vapor Sorption (ASTM C1104): <2pecent by weight at 120 degrees Fahrenheit.

8. Density: Same as adjoining pipe insulation.

9. Composition Surface Burning Characteristics (UL 723, ASTM E84): Flamespread 25, smoke developed 50.

B. Equipment and Tank Insulation:

1. Description: Flexible pipe and tank insulation made of semi-rigid fibrous glass board material with a laminated Kraft-aluminum foil ASJ facing.

2. Operating Temperature (ASTM C411): 0 - 650 degrees Fahrenheit.

3. Length: 36 inches.

4. Size: 1-1/2 inches.

5. Material Standard: Comply with ASTM C1393, Type II.

6. Material Standard: Comply with ASTM C795.

7. Material Standard: Comply with ASTM C1136, Type II.

8. Material Standard: Comply with NRC Guide 1.36.

9. Jacket Temperature Limitation (ASTM C1136): -20 - 50 degrees Fahrenheit.

10. Jacket Permeance (ASTM E961): 0.02 perm.

11. Puncture Resistance (ASTM D781): 50 units.

12. Compressive Strength at 10 % Deformation (ASTM C165): 125 psf.

2.3 CELLULAR GLASS INSULATION

A. Rigid factory fabricated closed-cell equipment insulation:

1. Thermal conductivity "k" of btuh-in / hr-sq.ft. degree F at 75-degree mean temperature.

2. Density shall be an average of 8 lb./cu.ft.

3. Compressive strength of 100 psi.

2.4 ALUMINUM JACKET

A. Jacket for equipment and tanks shall be 0.16-inch-thick type 3105 aluminum with factory applied one mil polykraft moisture barrier.

B. Fitting covers shall be factory made 0.024-inch type 1100 aluminum to match pipe covering. Fitting covers shall be manufactured to ASTM C-450 standards.

PART 3 - EXECUTION

3.1 GENERAL

A. Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breeching, or stacks while hot.

E. Apply insulation using staggered joint method for both single- and double-layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least two (2) inches. Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, hand holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

J. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

3.2 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the equipment insulation manufacturer.

3.3 EXAMINATION

A. Site Verification of Conditions:

B. Verify that site conditions are acceptable for installation of equipment insulation.

C. Do not proceed with installation of equipment insulation until unacceptable conditions are corrected.

3.4 INDOOR CHILLED WATER PUMPS

A. Shall be insulated with rigid insulation board, two (2) inch thick, cut and formed into a box and secured in place with 3/4-inch-wide x .020 galvanized bands spaced on nine (9) inch centers. Bands shall be pulled snug over sheets of insulation board. All joints shall be well and neatly fitted and so arranged that the assembly may be dismantled with ease permitting access to the pump. All voids on the interior of box shall be filled with glass fiber blanket insulation. Exterior shall be finished with a trowel coat of vapor barrier mastic, a layer of one (1) inch mesh galvanized wire, and a coat of cement. Final finish shall be an eight-ounce canvas jacket, pasted and sealed in place.

B. Pipe insulation shall be extended over all cold parts of chilled water pumps not directly over drainage basin of pump base.

3.5 OUTDOOR CHILLED WATER PUMPS

A. Shall be insulated with cellular glass insulation, two (2) inch thick, cut and formed into a box and secured in place with 3/4-inch-wide aluminum bands spaced on nine (9) inch centers. Bands shall be pulled snug over insulation. All joints shall be well and neatly fitted and so arranged that the assembly may be dismantled with ease permitting access to the pump. Provide aluminum jacket over insulation.

3.6 ALUMINUM JACKET

A. Install insulating materials per manufacturer’s recommendations.

B. Install aluminum jacketing per manufacturer’s recommendations.

C. Apply aluminum jacketing by lapping, sealing with caulking mastic and strapping with 1/2-inch x 0.20-inch Type 3105 aluminum bands on 12-inch centers.

D. Use screws on vertical lines at circumferential joints. Space screws a maximum of 6 inches apart with a minimum of two screws per joint.

E. Lap joints against weather so that water will run off lower edge.

F. Use caulking mastic to seal circumferential laps on horizontal lines, longitudinal laps on vertical lines, and lap formed where aluminum jacketing meets mastic. Also seal any screws in jacketing.

G. Prevent corrosion-causing galvanic action by ensuring that aluminum jacketing does not come in direct contact with other metals.

H. Waterproof valve, flange, and fitting covers and irregular shapes with mastic.

I. Paint mastic with one coat of aluminum paint. Paint exposed metal parts (i.e., uninsulated valves, flanges, and fittings) with one coat of aluminum paint.

J. Equipment exposed in mechanical rooms and finished spaces less than 10 feet above finished floor shall have specified aluminum jacket for protection.

3.7 ABOVE GRADE CHILLED WATER COMPONENTS, INSULATED WITH FIBERGLASS

A. Location: Indoor, conditioned spaces

B. Support Inserts: At each support point, install a hard section of cellular glass on lower 180 degrees of piping, same thickness as adjacent insulation, to prevent compression at support bearing area. Seal and finish to match the adjoining insulation. Provide formed 16 ga. galvanized sheet-metal saddles.

C. Installation: All equipment must be clean and dry at time of installation. Seal laps on jacket with adhesive. Provide three (3) inch butt strips at each joint between sections and seal with adhesive.

3.8 ABOVE GRADE CHILLED WATER COMPONENTS, INSULATE WITH CELLULAR GLASS

A. Location: Outdoor, un-conditioned spaces and ventilated spaces

B. The insulation shall be applied to equipment with all joints tightly butted. Joints may be rubbed slightly to achieve a tight fit. Seal all joints full depth with sealant. Insulation shall be secured with strips of fiber reinforced tape on 12-inch centers. The tape strips shall overlap by 50 percent.

C. Apply asphalt mastic and 6 x 6 mesh fabric in accordance with manufacturer's recommended procedures.

D. Metal jacketing shall be applied over the vapor retarder mastic with all laps positioned to shed water. All laps should overlap a minimum of 2 inches. Bands shall be spaced no greater than 12 inches on center.

E. After asphalt mastic application, fittings shall be covered with prefabricated metal fitting covers supplied by aluminum jacketing supplier.

3.9 INSULATION SCHEDULE

A. Chilled water components located within condition spaces.

1. Insulation thickness: Match adjoining piping thickness.

B. Chilled water components located in un-conditioned or ventilated spaces and outdoors

1. Insulation thickness: Match adjoining piping thickness.

3.10 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 07 16

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Pipe Insulation

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Provide pipe insulation systems which have been manufactured, fabricated, and installed to meet the current International Energy Conservation Code and all local amendments and criteria specified herein.

B. Performance Requirements: Provide pipe insulation systems which have been manufactured, fabricated, and installed to meet the following criteria:

1. NFPA 90A Installation of Air Conditioning and Ventilation Systems.

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. When manufacturer's cut sheets apply to a product series rather than a specific product, clearly indicate applicable data by **highlighting** or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show specific pertinent performance data and quantities appropriate to scope of work.

C. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

a. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

b. Detail attachment and covering of heat tracing inside insulation.

c. Detail insulation application at pipe expansion joints for each type of insulation.

d. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

e. Detail removable insulation at piping specialties.

f. Detail application of field-applied jackets.

g. Detail application at linkages of control devices.

1.5 QUALITY ASSURANCE

A. Installation Qualifications: Utilize an installer having demonstrated (5) five years experience on projects of similar size and complexity.

B. Condensation on any insulated piping system is not acceptable. Replace insulation damaged by condensation at no additional cost.

C. All materials shall conform to Composite Surface Burning Characteristics (UL 723, ASTM E84):

1. Flamespread: 25

2. Smoke developed: 50

D. All materials shall have U.L. label.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver insulation materials in manufacturer’s original, unopened, undamaged containers with identification labels intact

B. Contractor shall adequately protect insulation from damage after delivery to the project. Materials shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver materials to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass Fiber Pipe Insulation: Subject to compliance with plans and specification, provide one of the following:

1. Johns Manville
2. Owens Corning
3. Knauf

4. Certainteed

B. Cellular Glass Insulation: Subject to compliance with plans and specification, provide one of the following:

1. Pittsburg Corning
2. Cell-U-Foam

C. Phenolic Foam Insulation: Subject to compliance with plans and specification, provide one of the following:

1. Resolco
2. Koolphen® K

D. Aluminum Jacketing: Subject to compliance with plans and specification, provide one of the following:

1. Childers
2. Pabco
3. RPR

E. Fiberglass Reinforcing Cloth Mesh: Subject to compliance with plans and specification, provide one of the following:

1. Perma Glass Mesh
2. Alpha Glass Mesh
3. Childers Chil-Glas
4. Vimasco

F. Mastics and Adhesives: Subject to compliance with plans and specification, provide one of the following:

1. Childers
2. Foster
3. Vimasco

2.2 FIBERGLASS PIPE INSULATION

A. High density factory molded fiberglass insulation with factory applied all service, and reinforced vapor retarder jacket. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Provide thickness scheduled.

1. Thermal conductivity “k” of 0.23 of Btu-in / hr-sq.ft. °F at 75-degree mean temperature.
2. Maximum jacket permeance shall be 0.02.

2.3 CELLULAR GLASS INSULATION

A. Rigid factory fabricated closed-cell pipe insulation:

1. Thermal conductivity “k” of 0.32 Btuh-in / hr-sq.ft. °F at 75-degree mean temperature.
2. Density shall be an average of 8 lb/cu.ft.
3. Maximum jacket permeance shall be 0.02.
4. Compressive strength of 100 psi.

2.4 PHENOLIC FOAM INSULATION

A. Rigid factory molded phenolic foam insulation with factory applied, all service, and reinforced vapor retarder jacket. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Provide thickness scheduled.

1. Thermal conductivity “k” of 0.15 btu-in / hr-sq.ft. °F at 75°-degree mean temperature.
2. Maximum jacket permeance shall be 0.02.
3. Compressive strength of 100 psi

2.5 ALUMINUM JACKET

A. Jacket for piping shall be 0.016-inch-thick type 3105 aluminum with factory applied one mil polykraft moisture barrier.

B. Fitting covers shall be factory made 0.024-inch type 1100 aluminum to match pipe covering.

PART 3 -EXECUTION

3.1 SITE INSPECTION

A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.

B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturer’s recommendations.

3.2 PREPARATION

A. Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean and dry.

B. Ensure that insulation is clean, dry and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

C. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

3.3 INSTALLATION

A. Install all insulation materials and accessories in accordance with manufacturer’s published instructions and recognized industry practices to ensure that it will serve its intended purpose.

B. Install insulation on piping subsequent to installation of heat tracing, painting, and acceptance tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.

D. Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tears, or other damage. All staples used on cold pipe insulation shall be coated with suitable sealant to maintain vapor barrier integrity.

E. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

F. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

G. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

H. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

I. Apply multiple layers of insulation with longitudinal and end seams staggered.

J. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

K. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

L. Keep insulation materials dry during application and finishing.

M. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

N. Apply insulation with the least number of joints practical.

O. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

P. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

Q. Apply insulation continuously through hangers and around anchor attachments.

R. For insulation application where vapor retarder is indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

S. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

T. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

U. Insulation Terminations: For insulation application where vapor retarder is indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

V. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

W. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.

2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.

3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder

4. Vapor-Retarder Mastics: Where vapor retarder is indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings, at penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

5. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

   b. Seal penetrations with vapor-retarder mastic

   c. Apply insulation for exterior applications tightly joined to interior insulation ends.

   d. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.

   e. Seal metal jacket to roof flashing with vapor-retarder mastic.

6. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

7. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

8. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

   a. Fire stopping and fire-resistive joint sealers are specified in Division 7.

9. Floor Penetrations: Apply insulation continuously through floor assembly.

   a. For insulation with vapor retarder, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

X. Insulation Installation of Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.

2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 feet to form a vapor stop between pipe insulation segments.

3. For insulation with factory-applied jackets without integral vapor retarder, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Y. Insulation Installation on Pipe Flanges:

1. Apply preformed cellular-glass pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cellular-glass block insulation.

4. Install jacket material with manufacturers recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

Z. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of molded cellular-glass insulation and match thickness to that of adjoining pipe. Fittings and fabricated segments shall be securely held in place with ½ inch x 0.20-inch type 3105 aluminum bands.

    a. After segments have been banded, apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.

    b. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.

    c. Overlap mastic and fiberglass cloth by 2 inches on adjoining sections of pipe insulation.

AA. Insulation Installation on Valves:

1. Install preformed two-piece factory molded cellular-glass insulation to valve body, match adjoining pipe insulation thickness. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. Install insulation to flanges as specified for flange insulation application.

    a. After segments have been banded, apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.

    b. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.

c. Overlap mastic and fiberglass cloth by 2 inches on adjoining sections of pipe insulation.

BB. PVC Cover:

1. Provide factory molded covers for all fittings, elbows and flanges.

3.4 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

a. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.

b. Embed 10 x 10 fiberglass cloth between two 0.062-inch-thick coats of jacket manufacturer's recommended adhesive.

c. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Apply foil and paper jackets where indicated.

a. Draw jacket material smooth and tight.

b. Apply lap or joint strips with the same material as jacket.

c. Secure jacket to insulation with manufacturer's recommended adhesive.

d. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints. Where vapor retarder is indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder mastic to ends of insulation at intervals of 15 feet to form a vapor stop between pipe insulation segments.

e. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

3.5 CHILLED WATER, HOT WATER, CONDENSATE DRAIN AND MISCELLANEOUS PIPING SYSTEMS

A. Location: Indoor, conditioned spaces - return air plenums, air handling unit rooms.

B. Insulation Type:

1. Heating Water and Condensate Piping: **Fiberglass**

2. Chilled Water Piping: **Phenolic Foam**

C. Support Inserts: At each support point, install a hard section of cellular glass (two halves) around entire circumference of piping, same thickness as adjacent insulation, to prevent compression at support bearing area. Sealed and finished to match the adjoining insulation. Cellular glass length shall overhang a minimum of 2” on both sides of the saddle. Refer to 3.5, E for saddle length requirements.

D. Provide formed 16 ga. galvanized sheet-metal saddles with flared edges for protection of vapor retarder jacket and insulation. Saddles shall be short ribbed to secure saddle inside

hanger, and prevention of saddle movement. Pipe saddles shall be secured on both ends with aluminum banding with a thickness of 0.20, ¾" width and joined with ¾" aluminum wing seals.

E. Provide formed 16 ga. galvanized sheet-metal saddles as follows:

1. Insert and saddle lengths:

a. 1-1/2 inch through 2-1/2-inch pipe - 10 inches Long
b. 3 inch through 6-inch pipe - 12 inches Long
c. 8 inch through 10-inch pipe - 16 inch Long
d. 12 inches and larger pipe - 22 inches Long

F. Installation on Piping: All piping must be clean and dry at time of installation. Seal laps on jacket with adhesive. Provide 3-inch butt strips at each joint between sections and seal with adhesive.

G. Provide vapor retarder on all cold-water piping. Install a sealed vapor stop every 15 feet.

3.6 CHILLED WATER, HOT WATER, CONDENSATION DRAIN AND MISCELLANEOUS PIPING SYSTEMS

A. Location: Outdoor, un-conditioned spaces (non-return air plenums) and ventilated spaces. Shall include but not limited to: boiler rooms, non-return air plenum mechanical rooms, chiller rooms, and pump rooms.

B. Insulation Type:

1. Condensate Piping: **Fiberglass**

2. Chilled Water and Heating Water Piping: **Phenolic Foam**

C. Cellular Glass Installation:

1. The insulation shall be applied to piping with all joints tightly butted. Joints may be rubbed slightly to achieve a tight fit. Seal all joints full depth with sealant. Insulation shall be secured with strips of fiber reinforced tape on 12-inch centers. The tape strips shall overlap by 50 percent.

2. Apply asphalt mastic and 6 x 6 mesh fabric in accordance with manufacturer's recommended procedures.

3. Aluminum jacketing shall be applied over the vapor retarder mastic with all laps positioned to shed water. All laps should overlap a minimum of 2 inches. Bands shall be spaced no greater than 12 inches on center.
4. After asphalt mastic application, fittings shall be covered with prefabricated metal fitting covers supplied by aluminum jacketing supplier.

D. Support Inserts: At each support point, install a hard section of cellular glass (two halves) around entire circumference of piping, same thickness as adjacent insulation, to prevent compression at support bearing area. Sealed and finished to match the adjoining insulation.

E. Provide formed 14 ga. galvanized sheet-metal saddles with flared edges for protection of vapor retarder jacket and insulation. Saddles shall be short ribbed to secure saddle inside hanger, and prevention of saddle movement. Pipe saddles shall be secured on both ends

with aluminum banding with a thickness of 0.20, ¾" width and joined with ¾" aluminum wing seals.

F. Provide formed 14 ga. galvanized sheet-metal saddles as follows:

1. Insert and saddle lengths:

a. 1-1/2 inch through 2-1/2-inch pipe - 10 inches Long
b. 3 inch through 6-inch pipe - 12 inches Long
c. 8 inch through 10-inch pipe - 16 inch Long
d. 12 inches and larger pipe - 22 inches Long

G. Installation on Piping: All piping must be clean and dry at time of installation. Seal laps on jacket with adhesive and vapor retarder mastic. Provide 3-inch butt strips at each joint between sections and seal with adhesive.

H. Provide vapor retarder on all cold-water piping. Install a sealed vapor stop every 15 feet.

3.7 ALUMINUM JACKET

A. Install insulating materials per manufacturer's recommendations.

B. Install aluminum jacketing per manufacturer's recommendations.

C. Apply aluminum jacketing by lapping and sealing with caulking mastic and strapping with 1/2-inch x 0.20-inch Type 3105 aluminum bands on 12-inch centers.

D. Use screws on vertical lines at circumferential joints. Space screws a maximum of 6 inches apart with a minimum of two screws per joint.

E. Lap joints against weather so that water will run off lower edge.

F. Use caulking mastic to seal circumferential laps on horizontal lines, longitudinal laps on vertical lines, and lap formed where aluminum jacketing meets mastic. Also seal any screws in jacketing.

G. Prevent corrosion-causing galvanic action by ensuring that aluminum jacketing does not come in direct contact with other metals.

H. Waterproof valve, flange, and fitting covers and irregular shapes with mastic.

I. Paint mastic with one coat of aluminum paint. Paint exposed metal parts (i.e., uninsulated valves, flanges, and fittings) with one coat of aluminum paint.

J. Pipe exposed in mechanical rooms and finished spaces less than 10 feet above finished floor shall have specified aluminum jacket for protection.

K. All exterior pipes shall have specified aluminum jacket for protection.

3.8 PROTECTION

A. Replace damaged aluminum jacketing and insulation, including insulation with vapor barrier damage and moisture-saturated insulation.

B. The insulation contractor shall advise the general and / or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.9 INSULATION SCHEDULE

A. Chilled water piping located within condition spaces.

1. Insulation thickness **(Phenolic Foam)**:

a. 1-1/2” thick insulation for: ½” through 2” pipe
b. 2” thick insulation for: 2-1/2” and larger pipe

B. Chilled water and hot water piping located in un-conditioned or un-ventilated spaces and outdoors.

1. Insulation thickness **(Phenolic Foam)**:

a. 1-1/2” thick insulation for: ½” through 2” pipe
b. 2” thick insulation for: 2-1/2” and larger pipe

C. Hot water piping located within conditioned spaces

1. Insulation thickness: **(Fiberglass):**

a. 1-1/2” thick insulation for: ½” through 1-1/2” pipe
b. 2” thick insulation for: 2” and larger pipe

D. Cold Condensate Drain Lines

1. Insulation thickness: **(Fiberglass):**

a. 1” thick insulation for all pipe sizes and locations

END OF SECTION 23 07 19

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Section 019114 "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

1.5 ALLOWANCES

A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Section 012100 "Allowances."

1.6 UNIT PRICES

A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Section 012200 "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.7 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.8 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.9 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.

4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.

5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.

6. Test and inspection reports and certificates.

7. Corrective action documents.

8. Verification of testing, adjusting, and balancing reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 Testing AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least [10] days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.

2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.

3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.

4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R Subcontractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in HVAC boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 230993 "Sequence and Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in HVAC piping Sections. HVAC&R **Subcontractor** shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test

section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.

2. Description of equipment for flushing operations.

3. Minimum flushing water velocity.

4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of hot-water and solar systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

H. Refer to plans and specifications for HVAC system type.

END OF SECTION 23 08 00

EQUIPMENT SHALL BID AS AN ALTERNATE

SECTION 23 09 23 - DIRECT DIGITAL CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Heating and cooling piping:

1. Control valves
2. Flow meters
3. Flow switches
4. Press and temp sensor wells & sockets
5. Temp sensor wells and sockets

B. Duct accessories:

1. Airflow stations
2. BAS control dampers
3. Terminal unit controls

1.3 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. Communications with Third Party Equipment:

1. Any additional integral control systems included with the products integrated with the work of this section shall be furnished with a BACnet interface for integration into the Direct Digital Control System described in this section (reference sequence of operations and points list for specifics). Those systems include:

a. Boilers
b. Chillers
c. Cooling Towers
d. Switchgear
e. Variable Speed Drives
f. Computer Room Units (MDF)
g. Rooftop Units

EQUIPMENT SHALL BID AS AN ALTERNATE

1.4 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.

B. The following sections constitute related work:

1. Division 01- General

2. Division 23 – Mechanical

3. Division 26 – Electrical

1.5 DESCRIPTION

A. General: The control system shall consist of a complete BAS system with a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphics. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface. If individual software seat licenses or keys are required provide a minimum of 4 additional licenses to accommodate multiple owner operators.

B. If manufacture offers a web-based BAS platform, the installing contractor shall provide the new web-based software and software updates required for this project. Additionally, the installing contractor shall provide all computer related components (BAS web server – reference specifications for hardware requirements) for the new software platform to function in a peer-to-peer environment.

C. The system shall directly control HVAC equipment as specified in Sequences of Operation. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints.

D. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms specified shall be BACnet objects.

1.6 GENERAL REQUIREMENTS

A. **No portion of the total contract will be declared substantially complete until the automatic temperature control system (BAS) has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of set point.**

B. **Building Automation System (BAS) Subcontractor shall participate in the third-party commissioning process. The self-checkout and testing shall still be required only after the Commissioning Agent CxA has tested and approved of the system. Functional testing conducted by the Commissioning Agent shall be performed with the participation of the Building Automation Systems subcontractor. In addition,**

EQUIPMENT SHALL BID AS AN ALTERNATE

the BAS subcontractor shall provide appropriate personnel for functional testing procedures conducted by Commissioning provider.

C. All warranties shall begin at substantial completion; warranties shall not begin at equipment start up or shipment.

1.7 APPROVED CONTROL SYSTEMS

A. The following are approved control system suppliers, manufacturers, and product lines:

1. Refer to 01 23 00 ALTERNATES for acceptable manufacturers.

1.8 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with Control System Manufacturer for a period of 10 years or greater. If the distributorship has not had duration of more than 10 years, the contractor will not be approved without the written approval prior to bid date (no exceptions).

2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

3. BAS Graphics shall be Three Dimensional Thermographic.

4. BAS provider shall warranty controllers for 1 years.

5. BAS Provider shall provide lifetime training for the lifecycle of the facility to the owner at no additional cost.

1.9 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authority’s codes and ordinances for these plans and specifications. At a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)

2. International Energy Conservation Code (IECC)

3. International Building Code (IBC)

4. Uniform Mechanical Code (UMC)

5. ASHRAE Standard 135-2016: BACnet - A Data Communication Protocol for Building Automation and Control Networks

1.10 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended

EQUIPMENT SHALL BID AS AN ALTERNATE

hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 seconds.
2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 seconds and shall automatically refresh every 15 seconds.
3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 seconds.
4. Object Command. Devices shall react to command of a binary object within 2 seconds. Devices shall begin reacting to command of an analog object within 2 seconds.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 seconds.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. Select execution times consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per second. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 seconds of other workstations.
9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.

Control Stability and Accuracy. Control loops shall maintain measured variable at set point within tolerances listed in Table 2.

Table1
Reporting Accuracy

Measured Variable	**Reported Accuracy**
Space Temperature	±2ºF
Ducted Air	±2ºF
Outside Air	±2ºF
Dew Point	±3ºF
Water Temperature	±2ºF
Delta-T	±0.25ºF
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±0.1 in. w.g.
Air Pressure (space)	±0.01 in. w.g.

EQUIPMENT SHALL BID AS AN ALTERNATE

Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO_2)	±50 ppm

Note 1: 10% - 100% of scale
Note 2: For both absolute and differential pressure
Note 3: Not including utility-supplied meters

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±0.2 in. w.g. ±0.01 in. w.g.	0-6 in. w.g. -0.1 to 0.1 in. w.g.
Airflow	±10% of full scale	
Space Temperature	±2.0ºF	
Duct Temperature	±3ºF	
Humidity	±5% RH	
Fluid Pressure	±1.5 psi ±1.0 in. w.g.	1-150 psi 0-50 in. w.g. differential

1.11 SUBMITTALS

A. Product Requirements: Provide one electronic copy and 4 hard copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. If requested, provide drawings as AutoCAD 2017 and 4 prints of each drawing on 8.5 x 11 paper and 1 electronic copy of each drawing. When manufacturer's cut sheets apply to a product series rather than a specific product, **clearly indicate applicable data by highlighting** or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Provide submittals on the following:

1. Direct Digital Control System Hardware

   a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.

   b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:

      1. Direct digital controllers (controller panels)

      2. Transducers and transmitters

      3. Sensors (include accuracy data)

      4. Actuators

5. Valves

6. Dampers

7. Relays and switches

8. Control panels

9. Power supplies

10. Batteries

11. Operator interface equipment

12. Wiring

c. Wiring diagrams and layouts for each control panel. Show termination numbers.

d. Floor plan schematic diagrams indicating field sensor and controller locations.

e. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Central System Hardware and Software

a. Complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used.

b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

1. Central Processing Unit (CPU) or web server

2. Monitors

3. Keyboards

4. Power supplies

5. Battery backups

6. Interface equipment between CPU or server and control panels

7. Operating System software

8. Operator interface software

9. Color graphic software
10. Third-party software

c. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.

d. Network riser diagrams of wiring between central control unit and control panels.

3. Controlled Systems

a. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.

b. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.

c. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.

d. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified. Indicate alarmed and trended points.

4. Description of process, report formats, and checklists to be used in Section 23 09 23 Article 3.15 (Control System Demonstration and Acceptance).

B. Schedules

1. Within two months of contract award, provide schedule of work indicating:

a. Intended sequence of work items

b. Start date of each work item

c. Duration of each work item

d. Planned delivery dates for ordered material and equipment and expected lead times

e. Milestones indicating possible restraints on work by other trades or situations

2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents. Submit 8 copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:

1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2017 and 6 prints of each drawing on 8 ½” x 11" paper.

2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of (Control System Demonstration and Acceptance).

3. Operation and Maintenance (O&M) Manual. Printed, electronic, or online help documentation of the following:

   a. As-built versions of submittal product data.

   b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.

   c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.

   d. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.

   e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.

   f. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.

   g. Graphic files, programs, and database on magnetic or optical media.

   h. List of recommended spare parts with part numbers and suppliers.

   i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.

   j. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.

   k. Licenses, guarantees, and warranty documents for equipment and systems.

   l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: The contractor shall provide training to owner personnel in a laboratory classroom environment. Each student shall be provided with a dedicated computer workstation utilizing a simulated BAS software platform that is installed for this project. The instructors shall have CEU accreditation for all training courses offered. Provide documentation for this requirement in the initial BAS submittal. If contractor does not have CEU instructor or offer these courses locally include cost for tuition, travel and boarding to send students to manufacturer training facility. The owner shall receive free training for the life of the system.

EQUIPMENT SHALL BID AS AN ALTERNATE

1. Operator Overview – Consists of general system navigation, scheduling functions, setpoint modifications and parameter adjustments.

2. Advanced Topics Overview – Detailed analysis of trend setup/configuration, trend historian, alarm setup, alarm actions (email, printing, etc.), point renaming, and detailed analysis of equipment parameters.

3. Program/Logic Manipulation – Modify system programs as needed for additions and modifications.

4. Graphic Manipulation – Modify system graphics as needed for additions and modifications.

5. Hardware Troubleshooting – Classroom setup shall have HVAC mock-up systems. Operators shall be able to interact with this live system through the BAS utilized for this project. Class will provide students the ability to identify and repair common problems regularly encountered.

6. Software Troubleshooting - Classroom setup shall have HVAC mock-up systems. Operators shall be able to interact with this live system through the BAS utilized for this project. Class will provide students the ability to identify and repair common issues that can be utilized via software modifications.

7. Central Plant Operation – At a minimum the instructor shall thoroughly explain different types of central plant equipment and proper system modifications that can be made to enhance system performance and energy savings.

8. HVAC System Training – Objective of this class is to provide basic HVAC system knowledge of various types of systems including types of air side distribution and water side distribution. Topics such as thermodynamics, psychometrics, de-humidification, and demand control ventilation shall be thoroughly explained.

1.12 WARRANTY

A. Warrant work as follows:

1. Warrant materials for specified control system and peripheral control devices free from defects for a period of **1 years** after certificate of substantial completion. Warrant all labor for a period of **1 year** after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request. Additionally, contractor shall offer 24/7 after-hours support to include alarm monitoring and associated dispatch service.

2. Provide graphic modifications for a period of 3 years from date of substantial completion. This shall include room number and equipment modifications as requested by the owner.

3. Provide telephone support free to the owner for a period of 3 years after substantial completion. This service includes technical support for all BAS equipment and shall include troubleshooting and problem resolution via the telephone or web services. Service shall be available during the hours of 7am to 5pm Monday – Friday.

EQUIPMENT SHALL BID AS AN ALTERNATE

4. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

5. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor or Owner identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

6. Exception: Contractor shall not be required to warranty existing devices except those that have been rebuilt or repaired during installation.

1.13 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics

2. Record drawings

3. Database

4. Application programming code

5. Documentation

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE/ANSI Standard 135-2016, BACnet.

B. Use existing Ethernet backbone for network segments marked "existing" on project drawings.

C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.

2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Sequence of Operations. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

E. Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.

F. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

G. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization (WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable the system to both read and write data.

1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.

2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.

3. For read or write requests, the system shall require username and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.

2.3 OPERATOR INTERFACE

A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. Existing manufacturer’s BAS web server and workstation can be utilized. In addition to the primary operator interface, the system shall include a secondary interface compatible with a locally available commercial wireless network and viewable on a commercially available wireless device such as a Wireless Access Protocol (WAP) enabled cellular telephone or personal digital assistant (PDA). This secondary interface may be text-based and shall provide a summary of the most important data. As a minimum, the following capabilities shall be provided through this interface:

EQUIPMENT SHALL BID AS AN ALTERNATE

1. An operator authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator.

2. The ability to view and acknowledge any alarm in the system. Alarms or links to alarms shall be provided on a contiguous list so the operator can quickly view all alarms.

3. A summary page or pages for each piece of equipment in the system. This page shall include the current values of all critical I/O points and shall allow the operator to lock binary points on or off and to lock analog points to any value within their range.

4. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.

B. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135-2016, BACnet Annex J.

C. Hardware. If providing a new server, each workstation or web server shall consist of the following:

1. Hardware Base. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified in Section 23 09 23 Paragraph 1.8. Hard disk shall have sufficient memory to store system software, one year of data for trended points specified in Sequences of Operation, and a system database at least twice the size of the existing database at system acceptance. Configure computers and network connections if multiple computers are required to meet specified memory and performance. Web server shall be Compaq Rack Mounted Server (or equal) with a minimum of:

   a. Dual Processor Intel Pentium 3.66 GHz processor

   b. 1 GB RAM

   c. 80 GB hard disk providing data at 100 MB/sec

   d. RAID 5 Configuration

   e. 128x CD-ROM drive

   f. Most Current Windows Server Operating System

   g. Serial, parallel, and network communication ports and cables required for proper system operation.

2. If providing a server, the server shall support one or more the following database types:

a. SQL Server 2012 R2
b. PostgreSQL
c. MySQL
d. MS Access

D. Operator Functions. Operator interface shall allow each authorized operator to execute the following functions as a minimum:

1. Log In and Log Out. System shall require username and password to log in to operator interface.

2. Point-and-click Navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.

3. View and Adjust Equipment Properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as setpoints, PID gains, on and off controls, and sensor calibration.

4. View and Adjust Operating Schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.

5. View and Respond to Alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) unneeded alarms.

6. View and Configure Trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.

7. View and Configure Reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.

8. Manage Control System Hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.

9. Manage Operator Access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

E. System Software.

1. Operating System: Web server or workstation shall have an industry-standard professional-grade operating system. Acceptable systems include Microsoft Windows XP Pro, Red Hat Linux, or Sun Solaris.

2. System Graphics: Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint. Graphics shall

    a. Functionality: Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

    b. Animation: Graphics shall be able to animate by displaying different image files for changed object status.

    c. Alarm Indication: Indicate areas or equipment in an alarm condition using color or other visual indicator.

    d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

F. System Tools. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. Operators shall be able to configure the system.

4. Online Help. Context-sensitive online help for each tool shall assist operators in operating and editing the system.

5. Security. System shall require a username and password to view, edit, add, or delete data.

    a. Operator Access. Each username and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object. Authorized operators shall be able to vary and deny each operator's accessible functions based on equipment or geographic location.

b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.

c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

6. System Diagnostics. System shall automatically monitor controller and I/O point operation. System shall annunciate controller failure and I/O point locking (manual overriding to a fixed value).

7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 93.Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

8. Alarm Messages. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.

9. Alarm Reactions. Operator shall be able to configure (by object) actions workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.

10. Alarm Maintenance. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.

11. Trend Configuration. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. The contractor shall configure all physical control points and software control points to accumulate trend data. Analog values shall be configured utilizing time-based intervals and digital values shall be configured for COV. Provide at a minimum of 250 samples per control point. If data can be stored locally at the controller level this information shall be archived at the central server or all BAS workstations.

12. Object and Property Status and Control. Operator shall be able to view, and to edit if applicable, the status of each system object and property by menu, on graphics, or through custom programs.

13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

14. Standard Reports. Furnish the following standard system reports:

a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.

b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.

c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:

1. Alarm History.

2. Trend Data. Operator shall be able to select trends to be logged.

3. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

15. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

16. Graphics Generation. Graphically based tools and documentation shall allow Operator to edit system graphics, to create graphics, and to integrate graphics into the system. Operator shall be able to add analog and binary values, dynamic text, static text, and animation files to a background graphic using a mouse.

17. Graphics Library. Complete library of standard HVAC equipment graphics shall include equipment such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. Library shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. Library graphic file format shall be compatible with graphics generation tools.

18. Custom Application Programming. Operator shall be able to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

a. Language. Language shall be graphically based or English language oriented. If graphically based, language shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks. If English language oriented, language shall be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and shall allow for free-form programming that is not column-oriented or "fill-in-the-blanks."

b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

g. Variables: Operator shall be able to use variable values in program conditional statements and mathematical functions.

1. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

2. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

19. BACnet. Web server or workstation shall have demonstrated interoperability during at least one BMA Interoperability Workshop and shall substantially conform to BACnet Operator Workstation (B-OWS) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L.

2.4 CONTROLLER SOFTWARE

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. System Security. See Paragraph 2.3.F.5 (Security) and Paragraph 2.3.F.14.c.3 (Operator Activity).

C. Scheduling. See Paragraph 2.3.D.4 (View and Adjust Operating Schedules). System shall provide the following schedule options as a minimum:

1. Weekly. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).

2. Exception. Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.

3. Holiday. Operator shall be able to define 24 special or holiday schedules of varying length on a scheduling calendar that repeats each year.

D. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

E. Binary and Analog Alarms. See Paragraph 2.3.F.7 (Alarm Processing).

F. Alarm Reporting. See Paragraph 2.3.F.9 (Alarm Reactions).

G. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

H. Maintenance Management. System shall generate maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in Section 23 09 93.

I. Sequencing. Application software shall sequence chillers, boilers, and pumps as specified in Section 23 09 93.

J. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs.

K. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

L. Energy Calculations.

1. System shall accumulate and convert instantaneous power (kW) or flow rates (gpm) to energy usage data.

2. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

3. System shall calculate a fixed-window average. Window interval start shall be defined by utility meter digital input signal to synchronize system's and utility's fixed-window averages.

M. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

N. On and Off Control with Differential. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.

EQUIPMENT SHALL BID AS AN ALTERNATE

O. Runtime Totalization. System shall provide an algorithm that can totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified.

2.5 CONTROLLERS

A. General. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Smart Actuators (SA) as required to achieve performance specified in Section 23 09 23 Article 1.8 (System Performance).

B. BACnet.

1. Building Controllers (BCs). Each BC shall have demonstrated interoperability during at least one BMA Interoperability Workshop and shall substantially conform to BACnet Building Controller (B-BC) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L.
2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.

3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.

4. Smart Actuators (SAs). Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ASHRAE/ANSI 135-2016, BACnet Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.

5. BACnet Communication.

    a. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.

    b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.

    c. Each AAC and ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

    d. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

C. Communication.

1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.

2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.

3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.

4. Stand-Alone Operation. Each piece of equipment specified in Sequences of Operation shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

D. Environment. Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -20°F to 140°F.

2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 32°F to 120°F.

E. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

F. Serviceability.

1. Controllers shall have diagnostic LEDs for power, communication, and processor.

2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.

3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Memory.

1. Controller memory shall support operating system, database, and programming requirements.

2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.

3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

H. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft.).

EQUIPMENT SHALL BID AS AN ALTERNATE

I. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

C. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall send a pulsed low-voltage signal for pulse width modulation control or an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. Pulse-Width Modulation. Control actuators designed for pulse-width modulation with a single binary output that cycle with variable on and off times as determined by the application software. Pulse-width modulation may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

J. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

EQUIPMENT SHALL BID AS AN ALTERNATE

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

    a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.

    b. Line voltage units shall be UL recognized, and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:

    a. Dielectric strength of 1000 V minimum

    b. Response time of 10 nanoseconds or less

    c. Transverse mode noise attenuation of 65 dB or greater

    d. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.8 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers.

1. Type. Control dampers shall have linear flow characteristics and shall be parallel- or opposed-blade type as specified below or as scheduled on drawings.

    a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.

    b. Other modulating dampers shall be opposed-blade.

    c. Two-position shutoff dampers shall be parallel or opposed-blade with blade and side seals.

2. Frame. Damper frames shall 13-gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.

3. Blades. Damper blades shall not exceed 8 inches in width or 48 inches in length. Blades shall be suitable for medium velocity (2000 fpm) performance. Blades shall be not less than 16 gauge.

4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better. Bearing with nylon or oil impregnated sintered bronze. ½” galvanized steel shafts.

5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade

seals shall leak no more than (10 cfm per ft ^{2}) at (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of (1500 fpm).

6. Sections. Damper sections shall not exceed 48 in. - 60 in. Each section shall have at least one damper actuator.

7. Linkages. Dampers shall have exposed linkages. Shall be concealed outside of the air stream within the damper frame.

B. Electric Damper and Valve Actuators.

1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.

2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS). 2 position damper operators with spring return to full travel position, built in auxiliary switches (motor end switches).

3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range.

4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.

5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 inch -.lb torque capacity shall have a manual crank.

6. Acceptable Manufacturers:

a. Belimo

C. Control Valves.

1. General. Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown.

2. Type. Provide two or three-way control valves for two-position or modulating service as shown.

3. Provide weatherproof enclosures (exterior use).

4. Damper actuators not acceptable for valves.

5. Water Valves.

a. Valves providing two-position service shall be quick opening. Two-way valves shall have replaceable disc or ball.
   1. 2” and smaller – screwed type, body and internal parts shall be bronze, stainless steel or other corrosion resistant metal.
   2. 2-1/2” or larger- flanged type, bodies cast iron or cast steel, seat and parts exposed to fluid bronze, stainless steel or other corrosion resistant metal.

b. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide the following minimum close-off pressure ratings.

1. Two-way: 100% of total system (pump) head.

2. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

c. Ports. Valves providing modulating service shall have equal percentage ports.

d. Sizing.

1. Two-position service: line size.

2. Two-way modulating service: select pressure drop equal to the greatest of twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 38kPa (5.5psi).

3. Three-way modulating service: select pressure drop equal to the smaller of twice the pressure drop through the coil exchanger (load) or 38kPa (5.5psi).

4. Two-way and three-way modulating valve shall be one or two sizes smaller than the pipe size.

5. Max pressure drop: Equal to pressure drop od coil or exchanger.

6. Relief and bypass valves: Sized according to pressure available.

7. Manual by-pass operator.

e. Fail Position. Water valves shall fail normally open or closed as follows unless otherwise specified.

1. Water zone valves: normally closed.

2. Heating coils in air handlers: normally closed.

3. Chilled water control valves: normally open.

4. Other applications: as scheduled or as required by sequences of operation.

f. Acceptable Valve and Actuator Manufacturers:

1. Belimo

D. Binary Temperature Devices.

1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation

heater, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented ABS plastic cover.

2. Line-Voltage Space Thermostats. Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented ABS plastic cover.

3. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 20 ft long. Element shall sense temperature in each 1 ft section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

E. Temperature Sensors.

1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 5 ft in length per 10 ft ^{2} of duct cross-section.

3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.

4. Space Sensors: Space sensors shall be stainless steel flush plate mounted type. Combo sensors acceptable for space temperature, CO_2 and Humidity.

5. Differential Sensors. Provide matched sensors for differential temperature measurement.

F. Humidity Sensors.

1. Duct and room sensors shall have a sensing range of 20%-80%.

2. Duct sensors shall have a sampling chamber.

3. Outdoor air humidity sensors shall have a sensing range of 20%-95% RH and shall be suitable for ambient conditions of 40°F-170°F.

4. Humidity sensors shall not drift more than 1% of full scale annually.

G. Flow Switches. Flow-proving switches shall be thermal dispersion type (IFM U 40100 or approved equal) or differential pressure type (air or water service). Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum).

1. Thermal dispersion type switches shall have relay output, wire break output and temperature output.

2. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 4 enclosure unless otherwise specified.

H. Relays.

1. Control Relays. Control relays shall be plug-in type, UL listed and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

I. Override Timers.

1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0-6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.
2. Override times shall be twist type, 60 minute and without hold feature.

J. Current Transmitters.

1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500-ohm maximum burden.

2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.

3. Unit shall be split-core type for clamp-on installation on existing wiring.

K. Current Transformers.

1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.

2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.

3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

L. Voltage Transmitters.

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.

2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be ±1% full-scale at 500-ohm maximum burden.

3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

EQUIPMENT SHALL BID AS AN ALTERNATE

M. Voltage Transformers.

1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.

2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.

3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

N. Power Monitors.

1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.

2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.

O. Current Switches.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

P. Pressure Transducers.

1. Transducers shall have linear output signal and field-adjustable zero and span.

2. Continuous operating conditions of positive or negative pressure 50% greater than calibrated span shall not damage transducer sensing elements.

3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Transducer shall have 4-20 mA output, suitable mounting provisions, and block and bleed valves.

4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 1000 kPa (150 psi). Over-range limit (differential pressure) and maximum static pressure shall be 2000 kPa (300 psi.) Transducer shall have 4-20 mA output, suitable mounting provisions, and 5-valve manifold.

Q. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

R. Pressure-Electric (PE) Switches. PE switches shall be UL listed, pilot duty rated (125 VA minimum) or motor control rated, metal or neoprene diaphragm actuated, operating pressure rated for 0-175 kPa (0-25 psig), with calibrated scale minimum setpoint range of 14-125 kPa (2-18 psig).

1. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application.

2. Switches shall be open type (panel-mounted). Exception: Switches shall be enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.

3. Each pneumatic signal line to PE switches shall have permanent indicating gauge.

S. Air Flow Measuring Station

1. Multi-point sensors in one or more probe assemblies with a maximum of one to sixteen sensor nodes per location, and a single remotely mounted microprocessor-based transmitter for each measurement location. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Each sensing point shall independently determine the airflow rate and temperature at each node, which shall be equally weighted in calculations by the transmitter prior to output as the cross-sectional average. Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Each independent temperature sensor shall have a calibrated accuracy of +/-0.14° F (0.08° C) over the entire operating temperature range of -20° F to 160° F (-28.9° C to 71° C).and be calibrated at 3 temperatures against standards that are traceable to NIST. Acceptable manufacturer shall be EBTRON, Inc. GTx116-PC.

2. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.

3. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of Reading over the entire calibrated airflow range of 0 to 5,000 fpm (25.4 m/s)and be wind tunnel calibrated at 16 points against air velocity standards that are traceable to NIST.

T. Local Control Panels.

1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.

2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.

3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

2.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate Section 23 09 23 work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 PROTECTION

A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site.

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.

2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Submittals. See Section 23 09 23 Article 1.9 (Submittals).

C. Test and Balance.

1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.

2. Train Test and Balance Contractor to use control system interface tools.

3. Provide a qualified technician to assist with testing and balancing the first 20 terminal units.

4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

D. Life Safety.

1. Duct smoke detectors required for air handler shutdown are provided and wired under Division 26.

2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23 and wired by Division 26.

3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 26.

E. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.

1. Communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).

2. Each supplier of a control's product shall configure, program, start up, and test that product to meet the sequences of operation described regardless of where within the contract documents those products are described.

3. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.

4. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.5 FIELD QUALITY CONTROL

A. Commissioning and start-up of the BAS system shall be performed factory certified employees of the BAS contractor or manufacturer. Under no instances shall electrical subcontractors perform this work.

EQUIPMENT SHALL BID AS AN ALTERNATE

B. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.7 (Codes and Standards).

C. Continually monitor field installation for code compliance and workmanship quality.

D. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.6 WIRING

A. To differentiate BAS wiring from that of other trades, all cable except for underground will have a **yellow outer jacket** (no exceptions).

B. Division 26 contractor shall supply a dedicated 120vac power to a junction box in each mechanical room for use by the BMCS.

C. A Conduit fill based on plenum 18-gauge 2 conductor:

1. 1/2 inch - No more than 4 conductors.

2. 3/4 inch - No more than 8 conductors.

3. 1 inch - No more than 12 conductors.

D. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations. Where the requirements of Section 23 09 23 differ from Division 26, Section 23 09 23 shall take precedence.

E. All wires whether control network or device wire shall be marked with Brady-type markers.

F. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

G. Low-voltage wiring shall meet NEC Class 2 requirements. Sub-fuse low-voltage power circuits as required to meet Class 2 current limit.

H. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

I. Install wiring in raceway where subject to mechanical damage and at levels below 10ft. in mechanical, electrical, or service rooms.

J. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

K. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

L. Do not install wiring in raceway containing tubing.

EQUIPMENT SHALL BID AS AN ALTERNATE

M. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at (5 ft) intervals.

N. Contractor shall install all low voltage communication wiring as per all TIA/EIA communication cabling standards. All cabling shall be installed in dedicated cabling support such as j-hook, d-rings, or saddles. All supports shall be supported directly from building structure. Do not support cabling or supports from ceiling grid wire, conduit, ductwork, piping, or other system cabling. All cabling must be installed in independent support for that given system and may not share supports or run-in same conduit or support. All cabling shall be supported every 5'-0" from approved cabling support method. Contractor shall bundle all system cabling and label all wiring for system they serve. All cabling passing thru walls shall require dedicated conduit sleeves with bushing to protect cabling during installation. Contractor shall provide 1 meter service loops at all device termination locations and 3-meter service loops at all head end termination locations. All low voltage HVAC control cabling shall be yellow in color unless specified otherwise. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

O. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

P. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

Q. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

R. Use color-coded conductors throughout.

S. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

T. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

U. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

V. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

W. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft.) in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size.

Y. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.7 COMMUNICATION WIRING

EQUIPMENT SHALL BID AS AN ALTERNATE

A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

D. Verify entire network's integrity following cable installation using appropriate tests for each cable.

E. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

F. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

G. Label communication wiring to indicate origination and destination.

H. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.8 FIBER OPTIC CABLE

A. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

3.9 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 1 ft. of sensing element for each 1 ft. ^{2} of coil area.

EQUIPMENT SHALL BID AS AN ALTERNATE

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall at designated location with sun shield.

I. Differential Air Static Pressure.

1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.

4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.

5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.

6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.

J. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.10 FLOW SWITCH INSTALLATION

A. Adjust flow switch according to manufacturer's instructions.

3.11 ACTUATORS

A. General. Mount actuators and adapters according to manufacturer's recommendations.

B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.

1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.

2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten linkage.

3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

4. Provide necessary mounting hardware and linkages for actuator installation.

3.12 IDENTIFICATION OF HARDWARE AND WIRING

A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.

B. Label pneumatic tubing at each end within 5 cm (2 in.) of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show instrument or item served.

D. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

E. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.

F. Label valves with nameplates.

G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

H. Label identifiers shall match record documents.

3.13 PROGRAMMING

A. Point Naming. Name points as shown on the equipment points list provided with each Sequence of Operation. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.

B. All DDC programming shall be accomplished through graphical programming, line code is unacceptable

C. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented.

1. Application Programming. Provide application programming that adheres to sequences of operation specified in Section 23 09 93. Program documentation or comment statements shall reflect language used in sequences of operation.

2. System Programming. Provide system programming necessary for system operation.

D. Operator Interface.

1. Standard Graphics. Provide graphics as specified in Section 23 09 23 Article 2.3 Paragraph E.2 (System Graphics). Show on each equipment graphic input and output points and relevant calculated points such as indicated on the applicable Points List located in the Sequence of Operation. Point information on graphics shall dynamically update.

EQUIPMENT SHALL BID AS AN ALTERNATE

2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation) as described in Section 23 09 23.

3. DDC screen graphic room numbers shall be based on final room graphics package. Obtain Architect/Owner approval of final room numbers prior to programming.

3.14 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.

1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 23 09 23.
2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.

3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.

4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.

5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.

6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.

7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.

8. Alarms and Interlocks.

   a. Check each alarm with an appropriate signal at a value that will trip the alarm.

   b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.

   c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

3.15 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to

tests specified in Article 3.15 (Control System Checkout and Testing). Provide Engineer with log documenting completion of startup tests.

1. Preliminary Review: At least 7 days prior to on-site demonstration, provide read-only username and password to Engineer for preliminary system review to be performed remotely. Engineer will review to verify all systems are connected and communicating and all points are reading properly, and graphics are complete. The Engineer will provide a report of any deficiencies. The contractor shall correct all deficiencies prior to on-site demonstration.

2. On-site Demonstration: Engineer, Owner, contractor(s) and any/all factory authorized equipment representatives shall be present to perform, observe and review system demonstration. Notify Engineer/Architect at least 10 days before system demonstration is scheduled.

    a. Demonstration shall follow process submitted and approved under Section 23 09 23 Article 1.9 (Submittals). Complete approved checklists and forms for each system as part of system demonstration.

    b. Demonstrate actual field operation of each sequence of operation as specified in Section 23 09 93. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Engineer. Provide and operate test equipment required to prove proper system operation.

    c. Demonstrate compliance with sequences of operation through each operational mode.

    d. Demonstrate complete operation of operator interface.

    e. Demonstrate each of the following.

    f. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. Engineer will require further tuning of each loop that displays unreasonably under- or over-damped control.

    g. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand-limiting setpoint, and status of setpoints and other affected equipment parameters.

    h. Building fire alarm system interface.

    i. Trend logs for each system. Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation in Section 23 09 93. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be

retrievable for use in other software programs as specified in Section 23 09 23 Article 2.3 Paragraph F.11 (Trend Configuration).

3. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

B. Acceptance.

1. After tests described in this specification are performed to the satisfaction of both Engineer and Owner, Engineer will accept control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Engineer will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.

2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in Section 23 09 23 Article 1.9 (Submittals).

3.16 CLEANING

A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.

B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.

C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

END OF SECTION 23 09 23

SECTION 23 09 23.18 - CARBON MONOXIDE MONITORING SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract and the requirements of Section 15050 apply to the work specified in this Section.

B. Gas detection system must meet or exceed Texas State Boiler Code 60.603-2015.

C. ETL Listed to UL61010-1, CAN/CSA C22.2 No 61010-1, and LADBS Approved.

D. Gas detection system must meet or exceed current OSHA and NIOSH alarm levels for personnel exposure to Carbon Monoxide.

1.2 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Submit in accordance with Division 1 and Section 23 05 00.

C. Provide Monitor Panel as required to provide function in this specification and as shown on drawings.

D. Provide panels with electrical characteristics shown on the electrical drawings.

E. Carbon Monoxide system shall be third party validated to UL61010.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for operation, replacement parts, spare parts list, and wiring diagrams.

1.4 WARRANTY

A. Furnish one (1) year manufacturer parts and labor warranty for complete monitoring system. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or startup will not be acceptable.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) year’s experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Monitoring system shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer’s protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and

trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. International Gas Detectors Tocsin controller & detector range
2. Honeywell / Vulcain

2.2 CARBON MONOXIDE (CO) GAS DETECTION SYSTEM

A. Provide a CO gas detection system designed to measure the level of escaping heating plant exhaust gases in multiple monitoring areas.

B. Gas detection must consist of a control panel that must be mounted outside of the risk area to enable pre-entry warning of room status and provide remote reset capability for the system (only once gas concentrations have reduced below any alarm levels).

C. Gas detection system must be capable of being expanded to include flammable gas detection (to cover the fuel gas leakage and ignition/explosion risk) and refrigeration detection to enable interconnection to co-located Chiller Plant Areas without any loss of monitoring or alarm performance.

D. **Shall be calibrated every (18) eighteen months and a record of calibration shall be posted in a conspicuous place.**

E. Gas detection system enclosures for controllers or detectors should be a minimum of NEMA 3S (IP54).

F. The gas detection system should consist of a central controller interconnecting with field mounted gas detectors of Electrochemical Cell technology. Interconnection between controller and field devices should be through a 2-core addressable multi drop highway highways depending on detector numbers and locations relative to controller. Detectors being mounted to best cover risk area according to current manufacturers and industry advice.

1. The gas detection system should be an addressable type interconnecting to all field devices on a 2-core screen mutli-drop highway. Controller should have a minimum of a single highway expandable to 32 gas detectors.

2. Addressable highway should have polarity independent cores utilizing Sentinel+ addressable protocol enabling simple and quick install without need for core identifications. Addressable highway should have a capacity of 32 detectors.

3. The gas detection system shall automatically and continuously monitor for CO over the range 0-100 ppm and compare concentrations to user-settable PPM limits per areas monitored for selected gas.

4. Gas detection system to be capable of zoning alarm areas to enable a co-located Chiller Plant Room to be incorporated into locally fitted Heating Plant Room systems but provide independent alarms.

5. The gas detection system shall be capable of being calibrated specifically for CO over the range 0-100 ppm to enable compliance to local and national codes.

6. The gas detection system shall be capable of interconnecting with and monitoring Electrochemical Cell technology with factory and field calibrated settings. Measurement range for CO will be 0-100ppm with an accuracy of +/-3% as a percentage of full scale in ambient temperature ranges of 32 to 122 degrees Fahrenheit and 5 percent to 90 percent ambient humidity (non-condensing).

7. The gas detection system controller shall have a minimum of:

   a. Common 24VDC 100mA output common to any alarm.

   b. Four (4) SPCO alarm contacts -three (3) are for alarm levels and one (1) for system fault.

   c. Three (3) indicator lights:

      1. green “on” for normal operation
      2. red “on” for alarm
      3. yellow “on” for system fault

   c. Modbus RS485 output for connection to external devices with full Modbus Map freely available for 3rd parties.

   d. Alarm and fault log capability for. Minimum of 1000 points.

7. All configuration and monitoring parameters on the gas detection controller may be accessed one or two ways concurrently:

   a. Via web enabled devices accessing controllers on-board Wi-Fi pages; access must be Password protected.

   b. Via Wi-Fi dongle connected onto detector (allowing access to all devices on highway); access must be password protected.

8. Three alarm levels shall be provided indicating three (3) independent “alarm” level conditions. Thresholds for all alarms are to be individually adjustable with a factory setting of 20 PPM for “Alarm 1”, 50 PPM for “Alarm 2”, and 100 PPM for “Alarm 3”. To minimize false alarms, the unit’s minimum/maximum alarm levels should be set at factory recommended settings in compliance with relevant local and national codes.

8. System should be capable of operation even though a fault occurs. Controller should have a fault Indicator light and display should detail nature of the Fault.

9. The gas detection system should have an electronics warranty of minimum 10 years; sensor warranty for CO to be a minimum of 3 years.

10. Periodic gas detection system bump testing, calibration and checking or adjustments shall be capable of being accomplished by one person. Gas detection system shall have a self-diagnostics and indication of diagnostic status. Diagnostics shall include the CO sensor/s.

11. Installation of gas detection system should follow manufacturers installation recommendations (see IGD 2 Wire Installers Guide).

2.3 GAS DETECTION CONTROL PANEL

A. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.

B. The control panel should have an auto-setup function upon initiation. Upon first powering the device should ask for a FIND function that enables it to interrogate the connected highway, recognize and download details of all connected devices and automatically set channels and alarm points without any personnel interaction.

C. The control panel provides remote programming, interrogation, and display functions to support the field mounted gas detectors. The system design supports compliance to the local and national codes.

D. The control panel accepts a minimum of 1 Sentinel+ addressable input capable of monitoring up to thirty-two (32) field mounted detectors.

E. Gas detector readings should be updated a minimum of once per second.

F. Back lit LCD – The “Display” mode will display the measured point in PPM. The display will show a green backlight to reflect a safe condition and the light ring around the controller jog wheel will also be backlit green.

G. The control panel should have the ability to log a minimum of 1000 events (alarms, resets, power activities etc.)

H. Upon alarm, the channel display displays the channel in alarm (with live gas data), the backlit display changes from GREEN SAFE to RED , the light ring around the jog wheel changes from GREEN to RED, an internal 85dB sounder activates and the red alarm LED illuminates. Depending upon alarm Cause & Effect one or more of the SPCO, 230VAC 4Amp programmable relays change state.

I. The LCD display indicates any input fault that may occur and identifies the fault area, upon FAULT the display will be backlit YELLOW, the light ring around the jog wheel changes from GREEN to YELLOW.

J. The Control Panel shall provide Modbus RS485 to enable to operate in parallel with building management systems for the monitoring and interrogation of the control panel data.

K. Control panel shall be able to “lock out” any instructions through the local keypad by password.

L. Upon power failure, the control panel will have the capability to restart all individual monitors on the system. Upon return of electrical power, the control panel will be able to re-boot itself and return to operation without loss of programming or stored data (one month downtime without loss of data as a minimum).

M. The control panel should be capable of operating devices up to 3000 feet from controller location dependent on cable core size and detector location.

N. Two-way communication via Sentinel+ to a maximum of 32 detectors linked together in daisy-chain fashion is required. An onboard Wi-Fi port should enable password protected access by any web enabled device.

O. The control panel shall have an operating temperature of 32° – 122°F.

P. The control panel power consumption shall be less than 10 watts maximum 85-230VAC and be capable of running on 50 to 60 HZ power supply.

Q. There shall be one common 24VDC output for local beacon sounders and four (4) relays in the monitor unit. Four (4) relays shall be available for customer connections. All relays shall be rated at 230VAC 4 AMP. Alarm relays shall be capable of being programmed within the gas detection range and options to be Rising or Falling, Latched alarms or Auto-reset, energized or none energized configurations.

   a. ALARM 1: The Alarm relay connection shall be provided for the addition of an audible or visual warning device, fan activation or Plant shutdown. This relay will energize in the event that an area for Alarm 1 level has been exceeded.

b. ALARM 2: The Alarm relay connection shall be provided for the additional of fan activation or plant shutdown. This relay will “energize” in the event that an area for Alarm 2 level has been exceeded.

c. ALARM 3: The Alarm relay connection shall be provided for the additional of fan activation or plant shutdown. This relay will “energize” in the event that an area for Alarm 3 level has been exceeded.

d. FAULT: The Fault relay shall be a normally energized relay automatically changing state upon FAULT or Power Loss.

O. Unit power consumption shall be less than 50 watts maximum, 230 volts AC and be capable of running on 60 Hz supply.

P. Program access to be denied by password to prevent unauthorized personnel from accessing the device. Program will automatically reset to full function settings following power interruption.

Q. Gas detection. Controller must be capable of operating additional flammable detectors (for fuel gas leak detection within Heating Plant Room and/or refrigerant detectors for Chiller Room.

R. Gas detection system to be capable of zoning alarm areas to enable Chiller Plant Room systems to be incorporated into locally fitted Heating Plant Room systems but provide independent alarms.

S. Wiring connections shall be through 20mm electrical ports located on the bottom panel of the enclosure. Rear of control panel should be capable of being rotated to enable cable ports to be placed top or bottom. Rear panel knock outs should also be provided for cable entries.

2.4 GAS DETECTORS

A. The gas detectors shall be electrochemical cell technology with factory and capable of field calibration.

B. Gas detectors must be provided pre-calibrated and be able to interact with the control panel during its initial FIND operation to automatically set up the details of gas type, range and alarm points.

C. Gas detectors shall be 2 wire addressable technology compatible with Sentinel+ protocol and polarity independent connection.

D. Gas detectors shall have inboard I/O to enable (as a minimum) a 24VDC beacon sounder to be connected locally (maximum rating 100mA). Beacon sounder functions to be split for independent beacon & sounder operation (muting etc.).

E. Gas detectors to have an onboard Volt Free SPCO Relay rated 230VAC 4 Amp to enable local switching of plant (ventilation, heating plant de-activation, solenoid closure etc.).

F. Gas detectors should have a “hot swappable” front that enables gas sensors to be exchanged at end of life, upgraded, or swapped to other technologies or gas types upon plant change requirements.

G. Measurement range for CO with an accuracy of +/- 3% of full scale in ambient temperature ranges of 32 to 122 degrees Fahrenheit and 5 percent to 90 percent ambient humidity (non-condensing).

H. The gas detection system shall adhere to a temperature drift tolerance of 0.3 percent per degrees Celsius and have a sensitivity of 1 PPM (parts per million).

I. Gas monitoring should be continuous.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install panels and all detectors as shown on the drawings. Sufficient clearances allow easy service, maintenance, and replacement components.

B. Controller should always be placed outside of the Plant Room to enable pre-entry warning to personnel of room status.

C. Remote reset capability for the system should be at the controller and external of the Heating Plant Room.

D. Provide a combination strobe light and horn inside plant room to enable an evacuation alarm to be provided. The audible alarm shall be heard over the background room noise. The strobe light shall be energized when there is an alarm.

E. Installation of gas detection system should follow manufacturers installation recommendations (see IGD 2 Wire Installers Guide).

F. Demonstrate all functions of CO gas detection system.

G. Train the Owner on operations and maintenance of CO detection system.

3.2 SEQUENCE OF OPERATION

A. Refer to Section 23 09 93 Sequence of Operations for HVAC Controls for detailed CO sequence of operation requirement.

B. Carbon Monoxide detection system shall monitor the presence of CO in the Heating Plant Room. If CO is detected, a scaled automatic system of room evacuation and plant shutdown will be initiated linked to detected gas concentrations. The following sequence shall also be initiated from a manual switch located on the CO detection system panel. The CO system supplier shall provide a "dry" set of contacts, initiated automatically. On activation of the contacts, the following sequence shall occur.

1. Exhaust fan (Refer to plans for tag) shall be energized to high speed (if in place).,

2. Heating plant (refer to plans for tag) shall be de-energized to prevent further gas propagation.

3. BAS to be informed of alarms.

4. Provide an audible and visual alarm in the Heating Plant Room. Initiate the alarm and flash the light when the exposure limit is exceeded.

5. Control sequence above shall be accomplished by hard wire interlocks.

3.3 DEMONSTRATION AND TRAINING

A. Demonstrate system operations and verify specified performance. A functional test of the installed system shall be performed to demonstrate proper functioning of all interlocks and protective systems specified or otherwise required. This testing shall be conducted in the presence of the Owner's representative and the Engineer. The Contractor shall submit test procedure for approval by the Engineer prior to testing.

END OF SECTION 23 09 23.18

SECTION 23 09 93 - SEQUENCES OF OPERATION FOR HVAC CONTROLS
GENERAL:

- The BAS contractor shall provide all points listed under “Equipment Control Points” as well as any points required to accomplish the sequences of operation listed below. Refer to Specification 23 09 23 for input/output device specifications. Refer to contract drawings for additional items that may not be included in this specification. **At the 11 month walk-thru, BAS contractor shall provide an additional DDC demonstration (in addition to the demonstration before substantial completion) and re-verification of point-to-point control of all equipment points and sequences with Owner and Engineer; no exceptions.**

- This specification Section 23 09 93 is an extension of Specification Section 23 09 23. All items mentioned in Section 23 09 23 shall be tied to this section and all BAS contractors bidding this Section are responsible for both specifications.

- No portion of the total contract will be declared substantially complete until the graphics and automatic temperature control system has been demonstrated to be complete and functioning as intended. The BAS system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of set point.

- BAS contractor shall schedule and participate in a pre-construction integration meeting with all vendors providing BACnet/Modbus or other equipment that is being integrated to the BAS. Sample graphics shall be submitted for owner review. The meeting is a requirement and shall include but not limited to:

    - Communications Requirements (MSTP/IP)
    - Points (Read/Write)
    - Connection Requirements (CAT5/6, 2-wire, 4-wire)
    - Coordinate Communication speeds when devices are MSTP.
    - Coordinate or Establish Device Instance Numbering System
    - Coordinate final points list(s) with owner/engineer

- BAS contractor shall provide and install all low voltage control wiring (with conduit if located outdoors or exposed below ceiling) for equipment such as but not limited to boilers, split systems, rooftop units, IDF/MDF units, unit heaters, dust collectors, welding equipment, etc. to facilitate communication between equipment.

- Building automation systems sub-contractor shall provide and install step down transformers in each mechanical room and run low voltage communication wiring power loops to serve low voltage actuators installed at each Air Terminal Unit.

- All BAS exposed control wiring below the ceiling and especially outdoors (rigid) shall be in conduit; furnished and installed by BAS subcontractor.

- All gas, water, irrigation and cooling tower makeup metering devices (Natural Gas, Domestic Water, etc.) shall be provided by BAS and installed by plumbing contractor. BAS to provide BACnet/MSTP interface to each meter.

- All electric metering devices (Shark Electric Meter 200 & Electrical sub meters) shall be provided and installed by electrical contractor. BAS to provide BACnet/MSTP interface to each meter.

- All outside air dampers serving outside air handling units shall be stainless steel. Mount outside air dampers in lower elevation without the use of a ladder for accessibility. The controls contractor is responsible for providing dampers to be installed within duct for mechanical contractor to install.

- The packaged, indirect-fired, outdoor, cooling and heating makeup-air unit shall have a factory furnished control panel with BACnet interface. The BAS contractor shall provide and install wiring to the BACnet interface and provide programming to monitor and control the system. The front-end BAS system shall have the capability to monitor and control all points listed in “Equipment Control Points” and any additional points required to accomplish sequences of operation. BAS subcontractor shall coordinate with the rooftop unit representative to facilitate and integrate equipment system control prior to owner demonstration.

- Equipment provider must provide a certified controls start-up technician in order to assist with integration. This includes but is not limited to the following:

    - Inputting the device address, MAC address or IP address. (If equipment is to be BACnet/IP the equipment manufacturer shall be responsible for making sure the equipment points are pulled into customers network)

    - Ensuring appropriate points mapped and enabled. Assistance with pulling in points onsite is to be included for ALL equipment with on-board controls. Equipment controls technician is to be onsite with BAS Controls tech.

    - Equipment point Read/write option selection as needed.

    - All points pulled into onboard controller are reading properly through on-board controller and through the BAS interface, with points matching.

    - BACnet Priority levels are not holding out commands from BAS.

    - The controls contractor is not responsible if there is a differentiation in how the on-board controls are programmed compared to the design SOO.

    - Remote technical assistance is not to be the BAS controls responsibility in order to troubleshoot and diagnose control through BACnet

- BAS shall BACnet interface to boilers, VFDs, utility meters, and equipment provided with on-board controls. Water and Gas meters to be provided by controls contractor. See schedule on mechanical plans.

- Any BACnet interfaced equipment must come with an onboard controller that is BTL listed. The BACnet controller must make all BACnet points available to the BMS.

- Equipment manufacturer for BACnet controlled equipment must provide onsite dedicated resources for the setup of the integration to BMS.

- Controls to provide CO monitoring station.

- Combo Space Temperature, CO_2, and Humidity Sensor is acceptable.

- Space Temperature Sensors shall be stainless steel flush plate type without adjustments or readings.

- HVAC shutdown button shall be yellow color push off-twist reset. In clear non-lockable cover labeled "HVAC Emergency Shutdown". Located behind Admin Secretaries Desk.

- Control panels to have laminated engraved nameplates with "as installed" control diagrams.

- NEMA 1 enclosures for indoor panels, NEMA 4 for outdoor panels. Continuous piano type hinged doors, key-lock latch and removable sub-panels.

- Each control panel with control power source power switch (on-off) with overcurrent protection.

- CO2 sensors in vandal proof vented lockable enclosures in high occupant/traffic areas (i.e. Gyms, Library, Auditorium, Hallways, etc.)

- Each AHU and EF BAS modules shall have hand off-Auto (HOA) switches on all outputs for HVAC and electrical, including digital outputs.

1. CHILLED WATER SYSTEM – PRIMARY / SECONDARY PUMPING

Central plant consists of two (2) equal sized air-cooled chillers with dedicated primary chilled water pumps and secondary chilled water pumps for primary/secondary pumping system; refer to mechanical piping plans. **Each chiller shall be provided with a BACnet interface for read and write capability; BAS subcontractor to run communication wiring to each chiller.**

Equipment Control Points:
Plant CHW Supply Temperature - AI
Plant CHW Return Temperature – AI
Plant CHW Flow – AI
Building CHW Differential Pressure – AI
Decouple Loop Temperature – AI
Decouple Loop Flow – AI
CHW Supply Temperature (Typ. 3) – AI

Chiller Amps/Status, each chiller -AI
Chiller CHW Supply Temperature, each chiller – AI
Chiller Panel Output Contacts, each chiller - AI
Chiller Alarm, each chiller – DI
Primary Chilled Water Pump Status, each pump - DI
Secondary Chilled Water Pump Status, each pump – DI
Chiller Start/Stop, each chiller – DO
Secondary Chilled Water Pump Start/Stop, each pump – DO
Primary Chilled Water Pump Start/Stop, each pump – DO
Secondary Chilled Water Pump Speed Control, each pump – AO
Chiller Reset, each chiller – AO

Chilled Water System Activation
The chilled water system shall be activated by a request for cooling from any unit it supplies with chilled water. The number of cooling requests required and the length of time the requests must be received before activating the plant shall be operator adjustable. The chilled water system shall be disabled if the outside air temperature is less than 45°F (operator adjustable).

Chiller Activation
When a chiller is activated, the BAS shall send a start command to the lead chillers controller. The BAS shall wire the primary pump aux. output contacts from the main chiller controller as inputs into the BAS controller. Upon receiving an input to start the pumps from the chiller controller, the BAS shall send the start command to the associated dedicated CHW primary pump starters. If the chiller alarm input closes (indicating that the chiller has alarm), the BAS shall generate an alarm at the central site computer, discontinue the start signal to the chiller and energize the next chiller in sequence to run in the same manner as described above.

Chiller Sequencing

A current sensor at each chiller shall monitor the amperage of each chiller. The BAS shall also receive temperature inputs from sensors mounted in the building's common supply and return piping. If the enabled chiller or chillers current load monitor indicates that the chiller or chillers are operating above 95% capacity and the building supply water temperature rises greater than 3°F (adjustable) above set point for five (5) minutes (adjustable) the next chiller in sequence shall be enabled into operation by the above-described sequence.
With more than one chiller operating, if the combined load decreases to 80% (adjustable) capacity of previous state for ten (10) minutes (adjustable) and the building supply water temperature is less than 3°F (adjustable) above set point, a chiller shall be de-energized.

The equal size chillers shall be lead-lag alternated weekly at an operator adjustable time and day of the week by the BAS based upon accumulative runtime.

Secondary Chilled Water Pump Control
The secondary pumps shall be requested to run from the equipment being served. When the chilled water system is active, the lead secondary chilled water pumps (SCHP) shall be enabled. When the SCHP is commanded to run a current switch shall prove status to the BAS, which shall alarm at the central site if the switch is not made within 20 seconds (adjustable). If the lead pump indicates a bad status alarm the BAS shall discontinue the start signal to the lead SCHP and energize the lag SCHP to run. The lag SCHP now becomes the lead SCHP. The SCHP's shall be lead-lag alternated weekly at an operator adjustable time and day of the week by the BAS based upon accumulative runtime.

A differential pressure sensor across the building chilled water supply and return lines for secondary system shall monitor building differential pressure across the mains. The BAS shall modulate the speed of the operating secondary chilled water pump to maintain the building chilled water differential pressure at setpoint (adjustable). If the lead SCHP is operating at greater than 90% (adjustable) and the building differential pressure is greater than 3 psi (adjustable) below setpoint for 5 minutes (adjustable) the lag SCHP shall be started in tandem with the lead pump. The lag pump shall run until both pumps are operating at less than 30 % (adjustable) for 5 minutes (adjustable) at which time the lag pump shall be disabled.

The BAS shall monitor the position of all of the chilled water valves of the units that each secondary pump set serves and the differential pressure setpoint shall be reset based on achieving a target valve position of 90%. There shall be a dead band of 5% to prevent hunting of the reset program. The chilled water flow shall not change by more than 10 percent per minute. The target valve position, the reset time, the dead band, and the rate of change values shall be operator adjustable.

Chilled Water Temperature Control
The BAS shall send a signal to the chiller reset to maintain the chiller controlling setpoint. The initial startup temperature shall be 42°F. If one chiller is operating, and the building is in a low load condition, the BAS shall reset the chiller supply temperature up to a maximum of 48°F to optimize the chiller runtime. The temperature shall reset no more than 2°F every 15 minutes (adjustable).

A low load condition is defined when only one SCHWP is running at minimum speed, and the most open CHW valve (selectable) is less than 50% for 30 minutes (adjustable).

Chilled Water Decoupled Loop
When the chilled water system is active, decoupled loop flow and temperature will be monitored and trended by the BAS. If the decoupled loop temperature is greater than chilled water supply by 10°F (adjustable), and the building supply temperature is greater than setpoint by 3°F (adjustable) for 30 minutes the plant shall increment to the next available state.

Freeze Protection
When the outdoor air temperature drops to 35°F (adjustable) or below, the BAS shall open the chilled water valves for flow through the coils for freeze protection and the secondary & primary chilled water pumps shall be activated to run until the low ambient temperature ceases to exist.

2. HEATING WATER SYSTEM

The heating water system is a fully condensing boiler hot water system with primary / secondary pumps with multiple condensing boilers (refer to plans for quantity). The boiler system shall be controlled by a sequencing panel provided by the boiler manufacturer equipped with a BACnet interface card for each boiler. The BAS contractor shall provide a BACnet interface with the Boiler sequencing panel to monitor pertinent data from the boilers such as but not limited to leaving water temperature, status, alarm, etc. The BAS shall control the secondary pumps; primary/circulating pumps shall be controlled by each integral boiler controller.

BAS shall provide and install low voltage control wiring and conduits connecting the boilers and for the end devices. Boiler enable shall be hardwired, not commanded via BACnet interface.

Equipment Control Points:
Building HW Supply Temperature – AI
Building HW Return Temperature – AI
Building HW Return Flow Meter – AI
Heating Water Supply Temperature – AI
Boiler Supply Temperature, each boiler – AI
Heating Water Differential Pressure – AI
Boiler Status, each boiler – DI
Boiler Alarm, each boiler – DI
Heating Water Pump Status, each pump – DI
CO Monitoring - DI
Boiler Enable, each boiler – DO
Heating Water Pump Start/Stop, each pump – DO
Heating Water Pump Speed Control, each pump – AO
Boiler Reset – AO
Boiler Room Space Temperature – AI
Boiler Room Supply Fan Start/Stop – Hardwired to Damper End Switch
Boiler Room Supply Fan Status – DI
Boiler Room Supply Fan Damper w/End switch – DO / Hardwired 24v to Fan S/S
Boiler Room Exhaust Fan Start/Stop – DO
Boiler Room Exhaust Fan Status – DI

Heating Water System Activation
The heating water pump shall be activated by a request for heating from any equipment it supplies with heating water. A current switch shall prove status to the BAS and shall alarm at the central site if the contacts are not made within 20 seconds (adjustable). Once the heating water pump has proven positive flow, the BAS shall request the boiler system to run.

If the hot water supply temperature is less than 95°F (adjustable) or the building hot water pump status is not indicating the building hot water pump is running, the BAS control module shall broadcast that hot water is not available.

HW System is to include a stand-by pump which will be commanded on if the BAS commands the lead primary pump, and the pump status does not prove for more than 30 seconds (adjustable).
HW Pumps shall be rotated weekly to maintain equal runtime.

The BAS shall enable the system. The boiler sequencer decides who is lead and brings on the lag. The boiler controller also auto rotates if an alarm on the lead boiler is indicated.

Differential Pressure Control
A differential pressure sensor across the building heating water supply and return lines (located 2/3 down longest pipe run) shall monitor building differential pressure across the mains. The BAS shall

modulate the speed of the lead heating water pump to maintain the building heating water differential pressure at setpoint (adjustable - final setpoint determined by TAB contractor).

The BAS shall monitor the position of all of the heating water valves and the differential pressure setpoint shall be reset based on achieving a target valve position of 90%. There shall be a dead band of 5% to prevent hunting of the reset program. The heating water flow shall not change by more than 10 percent per minute. The target valve position, the reset time, the dead band, and the rate of change values shall be operator adjustable.

Secondary HW Pumps shall be rotated weekly to maintain equal runtime.

Heating Water Temperature Reset: The heating water shall have a ratio
Reset based on outside air temperature and the following schedule:

Outside Air Temp	Less than 50°F	Hot Water Temp	140°F
Outside Air Temp	Greater than 70°F	Hot Water Temp	100°F

Carbon Monoxide Monitoring
A carbon monoxide sensor installed in the boiler room will alarm the BAS and shutdown the boiler. The BAS shall notify district maintenance personnel via e-mail and text message when the level of carbon monoxide rises above 100 ppm (adjustable). The sensor shall also alarm the BAS and shutdown the boiler upon loss of power to the sensor. Boiler Room supply fan will be de-energized, and the emergency boiler room exhaust fan will be energized to dilute the carbon monoxide levels in the room. A strobe light and audible alarm at the panel will be activated during an event. A pushbutton on the panel will silence the alarm and reset the system. Carbon monoxide sensor shall be calibrated every eighteen months and a record of calibration shall be posted in a conspicuous place.

Refer to specification section 23 09 23.18 for CO detection requirements.

Freeze Protection
When the outdoor air temperature drops to 34°F (adjustable) or below, the BAS shall open the hot water valves for flow through the coils for freeze protection. The hot water system shall be activated to run and the building HW supply set point shall be set to 100°F (adjustable) while running the boiler only until the low ambient temperature ceases to exist, or the building start-up time arrives.

Boiler Room Supply Fan
The BAS shall start/stop the supply fan to maintain a space temperature of 80°F (adjustable) during occupied and unoccupied modes.

3. COOLING ONLY VAV AIR TERMINAL UNITS – ELECTRICAL ROOMS

Equipment Control Points
Space Temperature – AI
Discharge Air Temperature - AI
Cold Deck Flow - AI
Cooling Damper – FM (floating motor)

Zone Occupancy
The parent AHU shall have an occupancy schedule assigned to it. Upon occupancy the AHU shall broadcast an occupancy signal to the terminal unit.

Temperature Control

When the zone becomes active, the VAV controller shall determine based on the space temperature, if cooling is required. If cooling is required, the cooling air damper shall be modulated open to its maximum cooling CFM setpoint (adjustable) and a run request shall be sent to the air handling unit serving the VAV. As the space temperature returns to setpoint, the VAV cooling air damper shall modulate to its operator adjustable minimum cooling CFM setpoint (30% of maximum).

Unoccupied Control
During the unoccupied time period, the VAV cooling damper shall be closed (adjustable). If the space temperature reaches the operator adjustable unoccupied setpoint of 95°F cooling, the required equipment shall be started and run to maintain the space temperature within the setpoints.

4. DUAL DUCT TERMINAL UNITS

Equipment Control Points
Space Temperature – AI
Space Humidity (2 per AHU) – AI (Add Monitoring Only)
Discharge Air Temperature - AI
Cold Deck Flow – AI
Hot Deck Flow - AI
Cooling Damper - FM
Heating Damper – FM (floating motor)

Zone Occupancy
Each dual duct terminal box shall have an occupancy/vacancy schedule, occupied heating/cooling setpoints and unoccupied heating/cooling setpoints assigned to it. As the occupancy time approaches, an optimum start/stop program shall calculate a start time based on current space temperature verses the occupied heating or cooling setpoint, assigned recovery rate, and outdoor air temperature -- all variables are operator assignable from the central site.

Temperature Control
When the zone becomes occupied, the air terminal unit controller shall determine, based on the space temperature, whether heating or cooling is required. If cooling is required, the cooling air damper shall be modulated open to its maximum cooling CFM setpoint (adjustable) and a run signal shall be sent to the air handling unit serving the terminal box. As the space temperature returns to setpoint, the terminal box controller cold air damper shall modulate to its minimum cooling CFM setpoint of 45% (adjustable) of maximum CFM. If heating is required, the heating damper shall modulate open to 45% (adjustable) of maximum CFM and the cooling damper shall close. If the temperature continues to drop, the heating damper shall modulate open to 100% (adjustable) of maximum CFM. The sequencing of the cooling and heating dampers shall maintain a minimum air flow of 45% (adjustable) of maximum CFM.

Unoccupied Control
During the unoccupied time period, the terminal box cooling and heating dampers shall be closed. If the space temperature reaches the unoccupied heating or cooling setpoints, the required equipment shall be started and run to maintain the space temperature within these setpoints: 55°F (adjustable) heating and 90°F (adjustable) cooling typical.

5. SERIES FAN POWERED AIR TERMINAL UNITS (CVB) – WITH HOT WATER HEAT

Equipment Control Points
Space Temperature – AI
Discharge Air Temperature - AI
Cold Deck Flow – AI
Fan Start/Stop - DO
Cooling Damper – FM
Re-Heat Valve – FM

Zone Occupancy
The parent AHU shall have an occupancy schedule assigned to it. Upon occupancy the AHU shall broadcast an occupancy signal to the terminal unit.

When the CVB Boxes calculated start time arrives its internal fan motor shall be energized and continue to run until the unoccupied period arrives.

Temperature Control
When the zone becomes active, the CVB controller shall determine, based on the space temperature, whether heating or cooling is required. If cooling is required, the cooling air damper shall be modulated open to its operator adjustable maximum cooling CFM setpoint and a run signal shall be sent to the air handling unit serving the CVB. As the space temperature returns to setpoint, the CVB cooling air damper shall modulate to its operator adjustable minimum cooling CFM setpoint.

The cooling damper actuator shall use a stepper motor so its position can be accurately tracked for display on the CVB graphic and collected by the air-handling unit serving the CVB to reset the air handling unit static pressure setpoint.

If heating is required, a run request will be sent to the heating water system (See Hot Water Sequence of Operation). The CVB terminal damper will be maintained at its adjustable minimum heating CFM setpoint, and the hot water reheat valve will be modulated to maintain the space temperature.

Unoccupied Control
During the unoccupied time period, the CVB cooling damper shall be closed (operator adjustable) and its fan shall be de-energized. If the space temperature reaches the operator adjustable unoccupied heating setpoints of 55°F, the terminal fan shall be enabled and shall modulate the HW valve to maintain the space temperature within setpoint. If the space temperature reaches the operator adjustable unoccupied cooling setpoint of 95°F, the required equipment shall be started and run to maintain the space temperature within the setpoints. See AHU for unoccupied sequence of operation.

6. SINGLE DUCT VARIABLE AIR VOLUME AIR HANDLING UNITS WITH DX COIL (AHU-A1-01)

Equipment Control Points
Supply Air Temperature – AI
Discharge Air Temperature, each coil – AI
Supply Air Static Pressure – AI
Fan Status – DI
Filter Status – DI
Static Pressure High Limit – DI
Air Handling Unit Fan Start/Stop – DO
Fan Speed Control – AO
Chilled Water Valve Control – AO
OA Damper Control – DO
Exhaust Fan Start/Stop – DO
DX Cooling Stages – DO
Freeze Stat – DI

AHU Activation
Each Single Duct variable air volume air handler shall be activated by a request to run from any Air Terminal Unit it serves.

Fan Control

When the air handler is requested to run, the B.A.S. control module will send signal to the air handler inverter, which will energize the fan. A current switch will prove status to the Building Automation System (BAS) and alarm the central site if the switch is not made within 20 seconds (operator adjustable). There will also be a 10 second (operator adjustable) de-bounce time to prevent nuisance alarms. A run request will be sent to the Chilled Water System when the air-handling unit is active, and cooling is required.

Cold Deck Temperature Control

When the air handling unit is in occupied mode and cooling is required, the BAS shall send a request for cooling to the chiller plant and shall modulate the chilled water control valve to maintain leaving air temperature setpoint (55 °F, adjustable). The BAS shall have the ability to reset the leaving air temperature based on cooling request. When there are no cooling requests, the leaving air temperature setpoint shall reset up to a maximum of 58 °F (adjustable). When 2 (adjustable) or more cooling requests are present, the leaving air temperature setpoint shall reset down to 52 °F (adjustable). The reset shall not exceed more than 0.2 °F (adjustable) every 3 minutes (adjustable).

Air Volume Control

While the air handling unit is active, the BAS shall maintain the duct static pressure setpoint at 1.5" w.g. (adjustable, final setpoint to be determined by TAB contractor) by modulating the speed of the supply fan through a variable speed drive (VSD). A static pressure sensor mounted two-thirds down the longest duct run shall monitor the duct static pressure. A manual-reset static pressure high limit switch shall monitor the static pressure of the supply duct. If the duct static pressure rises above 3.0" w.g. (locally adjustable) the air handling unit shall be de-energized via hard-wire interlock to the VFD safety circuit. The BAS shall monitor the high static limit switch and shall display an alarm at the central site. The static pressure high limit switch must be manually reset.

The static pressure shall reset to achieve a target damper setpoint of 85% with a 5% dead-band. Static pressure shall reset by not more than 0.2” W.C. every 3 minutes. Static pressure shall be a minimum of 0.5” W.C.

After Hours Cooling

The air handling unit is furnished with a Hydronic Cooling coil and in addition a Direct Expansion (DX) coil with matching air-cooled condensing unit. When the system is operating after hours, the BAS shall utilize the DX cooling for supply air temperature control and shall not send a request to the chiller plant.

Unoccupied Control

If the space temperature reaches the operator adjustable unoccupied setpoints of 55^0F (adjustable) heating and 95^0F (adjustable) cooling, the required equipment shall be started and run to maintain the space temperature within the setpoints. All values are operator adjustable.

If the space humidity reaches the operator adjustable unoccupied setpoints of 60% (adjustable), the required equipment shall be started and run to maintain the space humidity within the setpoints. All values are operator adjustable.
Humidity setpoints supersedes the temperature setpoints. The BAS shall initiate an alarm if temperature or humidity rises above unoccupied setpoint.

Freeze Protection

A manual reset low-limit temperature switch shall be mounted in the discharge air stream of the heating coil. The normally closed contacts of the switch shall be wired in series with the VSD safety interlock circuit so that, when activated, the VSD will shut down the fan. Upon sensing a low limit condition, the BAS shall open the HW and CHW control valves, close the outdoor air damper, energize the hot water pump and boiler (see heating water sequence of operation), and alarm at the central site.

Associated Equipment

During the occupied time period, the outside air damper shall be open and/or a request to run shall be sent to the corresponding exhaust fans and OAHU. The outside air dampers shall remain closed, the OAHU's & exhaust fans shall remain off, even during a scheduled occupancy time based on a global command from a shelter in place (building shutdown) button activation or based on a summer mode schedule.

Equipment OFF Conditions
When the air handling unit is de-energized, the cooling valve shall be closed, the outside air damper shall be closed, and any associated exhaust fans shall be de-energized.

7. DUAL DUCT AIR HANDLING UNITS (AHU-A1-02, AHU-B1-01, AHU-B1-02, AHU-C1-01, AHU-C1-02 & AHU-D1-06)

Equipment Control Points
Cold Deck Temperature – AI
Hot Deck Temperature – AI
Cold Deck Static Pressure – AI
Hot Deck Static Pressure – AI
Cold Deck High Static Limit – DI
Hot Deck High Static Limit – DI
Return Air Temperature – AI
Air Handler Fan Status – current switch – DI
Filter Status – DI
Chilled Water Valve Control – AO
Hot Water Valve Control – AO
Fan Speed Control – AO
Air Handling Unit Fan Start/Stop – DO
Outside Air Damper Control – DO

AHU Activation
Each Dual Duct VAV air handler shall be activated by a request to run from any Dual Duct VAV box it serves.

Fan Control
When the air handler is requested to run, the B.A.S. control module shall send signal to the air handler inverter, which will energize the fan. A current switch shall prove status to the Building Automation System (BAS) and alarm the central site if the switch is not made within 20 seconds (operator adjustable). There shall also be a 10 second (operator adjustable) de-bounce time to prevent nuisance alarms from a bouncing switch. A run request shall be sent to the Chilled Water System when the air-handling unit is active, and cooling is required. A run request shall be sent to the Heating Water System when the air-handling unit is active, and heating is required.

Temperature Control
Averaging element type temperature sensors covering the entire length of the cooling and heating coils shall monitor the Cold Deck and Hot Deck temperatures.

The Cold Deck control shall be enabled after the minimum request (2, adjustable) for cooling is received for three minutes from a Dual Duct VAV Box it serves as long as the outside air temperature is greater than 45°F. The number of cooling requests required, the delay duration, and the outside air temperature lockout shall be operator adjustable. When the Cold Deck control is enabled, the BAS shall modulate the chilled water control valve as required to maintain the Cold Deck temperature at a set point of 55°F (operator adjustable) or as noted on the Air Handling Unit schedule on the drawings or the operator shall be able to select that the Cold Deck set point shall be reset based on cooling requests from the Dual Duct VAV Boxes it serves. The reset based cooling request shall be between of 54°F and 57°F based on the number and the duration of the cooling

requests. The cold deck set point shall not change by more than 1/2 degree every three minutes with all temperature, reset time, and rate of change values operator adjustable.

The Hot Deck control shall be enabled after the minimum request (2, adjustable) for heating is received for three minutes from a Dual Duct VAV Box it serves as long as the outside air temperature is less than 65°F. The number of heating requests required, the delay duration, and the outside air temperature lockout shall be operator adjustable. When the Hot Deck control is enabled, the BAS shall modulate the hot water control valve as required to maintain the Hot Deck temperature at set point. The operator shall be able to select that the Hot Deck set point shall be reset based on the outside air temperature or based on heating requests from the Dual Duct VAV Boxes it serves. The outside air temperature reset schedule shall be a linear reset schedule with the initial setpoints of an 80°F hot deck at 65°F outside air temperature and 100°F hot deck at 36°F. All of the values shall be operator adjustable. The reset based heating request shall be between 80°F and 100°F based on the number and duration of the heating requests. The hot deck set point shall not change by more than 1 degree every five minutes with all temperature, reset time, and rate of change values operator adjustable.

Air Volume Control

The B.A.S. control module shall receive an input from a static pressure sensors located 2/3 down the longest heating duct and cooling duct runs. In response, the B.A.S. shall select the static pressure sensor that is lowest as compared to the static pressure set point and send a modulating signal to the variable speed drive, which will adjust the fan speed to maintain the static pressure at a set point of 1.5" (operator adjustable) or as determined by the balancing contractor to be the lowest setting required to allow the Dual Duct VAV Boxes to meet their air flow setpoints. A minimum airflow setting determined by TAB shall be required for each duct to prevent unnecessary HSL trips. The B.A.S. shall monitor the position of all of the heating and cooling dampers in the boxes that the air handler serves, and the static pressure set point shall be reset based on achieving a target damper position of 90%. There shall be a dead band of 5% to prevent hunting of the reset program. The static pressure set point shall not change by more than 1/8 inch every two minutes. The target damper position, the reset time, the dead band, and the rate of change values shall be operator adjustable.

Manual reset high static limit switches located in the discharge of the air handlers heating and cooling ducts shall de-energize the air-handling unit if static pressure exceeds 3.0" w.g. (locally adjustable) in either duct.

Associated Equipment

During the occupied time period a request to run shall be sent to the OAHU that supply's its outside air. The exhaust fans associated with the air handler shall also be energized only during the occupied time period. The OAHU's and exhaust fans shall remain off even during the scheduled occupancy time based on a global command from a shelter in place (building shutdown) button activation or based on a summer mode schedule.

An airflow switch shall monitor the pressure across the air filter. A contact closure from the air filter switch will alarm and notify maintenance through the B.A.S. of a dirty filter.

Equipment off Conditions

When the air-handling unit is de-energized, its chilled water valve and hot water valve shall be closed. The related exhaust fans shall be de-energized and the request to run to the OAHU shall be canceled.

Freeze Protection

While the units are off if the outside air temperature falls below 34°F (operator adjustable) the chilled water valve and hot water valves shall be opened to 20% (adjustable) and the secondary pumps shall run for freeze protection.

8. SINGLE ZONE VAV AIR HANDLING UNITS WITH HUMIDITY CONTROL (AHU-A2-02, AHU-D1-03, AHU-D1-04 & AHU-D1-05)

Equipment Control Points
Space Sensors – AI (Combo Temp & Humidity, without display)
Discharge Air Temperature – AI
Cooling Coil Discharge Air Temperature – AI
Reheat HW Coil Discharge Air Temperature – AI
Fan Status – DI
Filter Status – DI
Air Handling Unit Fan Start/Stop – DO
Exhaust Fan Start/Stop - DO
Fan Speed Control – AO
Chilled Water Valve Control – AO
Heating Water Re-Heat Valve Control - AO
OA Damper Control – DO

AHU Activation
The air-handling unit shall have an occupancy/vacancy schedule, occupied heating/cooling setpoints and unoccupied heating/cooling setpoints assigned to it. As the occupancy time approaches, an optimum start/stop program shall calculate a start time based on current space temperature verses the occupied heating or cooling setpoint, assigned recovery rate, and outside air temperature -- all variables are operator assignable from the central site. The air-handling unit control program shall have the ability to learn its recovery rate whenever the operator enables the learning feature.

Fan Control
When the air handler is requested to run, the B.A.S. control module shall send an enable signal to the air handler inverter, which will energize the fan. A current switch shall prove status to the Building Automation System (BAS) and alarm the central site if the switch is not made within 20 seconds (operator adjustable). There shall also be a 10 second (operator adjustable) de-bounce time to prevent nuisance alarms. A run request shall be sent to the Chilled Water System when the air-handling unit is active, and cooling is required. A run request shall be sent to the Heating Water System when the air-handling unit is active, and heating is required. As the zone temperature rises, the fan will modulate from its minimum speed (determined by the TAB contractor) to its maximum speed. As the zone temperature falls below the heating setpoint the fan will run at a fixed speed (determined by the TAB contractor) and the hot water valve will modulate to maintain the space heating temperature setpoint.

Temperature Control
A wall mounted space temperature sensor shall monitor the air temperature in the space. The B.A.S. shall output separate signals to modulate the chilled water and heating water control valve actuators in sequence to maintain the space temperature within its operator adjustable heating and cooling setpoints. As the zone temperature rises, the fan will modulate from its minimum speed (determined by the TAB contractor) to its maximum speed. As the zone temperature falls below the heating setpoint the fan will run at a fixed speed (determined by the TAB contractor) and the hot water valve will modulate to maintain the space heating temperature setpoint.

Space Humidity Control
A space humidity sensor, monitored by the B.A.S., shall set the cooling coil discharge air setpoint to 55^0F (adjustable) and modulate the chilled water valve to maintain the setpoint if the humidity rises above 60% (adjustable) and continue until it falls by 5% (adjustable). The B.A.S. shall modulate the hot water reheat valve to maintain the space temperature between its heating and cooling setpoints. If the B.A.S. control module is receiving a broadcast from the HW system that heating water is not available (see Heating Water System sequence of operations) the chilled water valve shall not be overridden until heating water is available. The fan will run at a fixed speed (determined by the TAB contractor) while in dehumidification mode.

Unoccupied Control
If the space temperature reaches the operator adjustable unoccupied setpoints of 55^0F (adjustable) heating and 95^0F (adjustable) cooling, the required equipment shall be started and run to maintain the space temperature within the setpoints. All values are operator adjustable.

If the space humidity reaches the operator adjustable unoccupied setpoints of 60% (adjustable), the required equipment shall be started and run to maintain the space humidity within the setpoints. All values are operator adjustable. Humidity setpoints supersedes the temperature setpoints. The BAS shall initiate an alarm if temperature or humidity rises above unoccupied setpoint.

Associated Equipment
During the occupied time period, the outside air damper shall be open. The exhaust fans associated with the air handler shall also be energized only during the occupied time period. The outside air dampers shall remain closed, the exhaust fans shall remain off, even during a scheduled occupancy time based on a global command from a shelter in place (building shutdown) button activation or based on a summer mode schedule. The Exhaust fans shall be commanded (off) during morning cool down / warm up and shall only turn on during the occupied time periods. General exhaust fans may require a separate schedule to accomplish this sequence and will be part of the commissioning sequence of operations to be demonstrated.

An airflow switch shall monitor the pressure across the air filter. A contact closure from the air filter switch will alarm and notify maintenance through the B.A.S. of a dirty filter.

Equipment OFF Conditions
When the air-handling unit is de-energized, its chilled water valve, hot water valve and OA damper shall be closed. The related exhaust fans shall be de-energized and the request to run to the OAHU shall be canceled. While the units are off if the outside air temperature falls below 34°F (operator adjustable) the chilled water valve and hot water valves shall be opened to 20% (adjustable) and the secondary pumps shall run for freeze protection.

9. SINGLE ZONE VAV AIR HANDLING UNITS WITH HUMIDITY CONTROL (AHU-D1-01, AHU-D1-02 & AHU-E2-01)

Equipment Control Points
Space Sensors – AI (Combo Temp, Humidity & CO_2, without display) (AHU-D1-01 & AHU-E2-01)
Space Sensors – AI (Combo Temp & Humidity, without display) (AHU-D1-02)
Discharge Air Temperature – AI
Cooling Coil Discharge Air Temperature – AI
Reheat HW Coil Discharge Air Temperature – AI
CO2 Level(s) – AI (refer to plans for quantities and locations)
Fan Status – DI
Filter Status – DI
Air Handling Unit Fan Start/Stop – DO
Exhaust Fan Start/Stop - DO
Fan Speed Control – AO
Chilled Water Valve Control – AO
Heating Water Re-Heat Valve Control - AO
OA Damper Control – AO
Airflow Measuring Station – AI

AHU Activation
The air-handling unit shall have an occupancy/vacancy schedule, occupied heating/cooling setpoints and unoccupied heating/cooling setpoints assigned to it. As the occupancy time approaches, an optimum start/stop program shall calculate a start time based on current space temperature verses the occupied heating or cooling setpoint, assigned recovery rate, and outside air temperature -- all

variables are operator assignable from the central site. The air-handling unit control program shall have the ability to learn its recovery rate whenever the operator enables the learning feature.

Fan Control
When the air handler is requested to run, the B.A.S. control module shall send an enable signal to the air handler inverter, which will energize the fan. A current switch shall prove status to the Building Automation System (BAS) and alarm the central site if the switch is not made within 20 seconds (operator adjustable). There shall also be a 10 second (operator adjustable) de-bounce time to prevent nuisance alarms. A run request shall be sent to the Chilled Water System when the air-handling unit is active, and cooling is required. A run request shall be sent to the Heating Water System when the air-handling unit is active, and heating is required. As the zone temperature rises, the fan will modulate from its minimum speed (determined by the TAB contractor) to its maximum speed. As the zone temperature falls below the heating setpoint the fan will run at a fixed speed (determined by the TAB contractor) and the hot water valve will modulate to maintain the space heating temperature setpoint.

Temperature Control
A wall mounted space temperature sensor shall monitor the air temperature in the space. The B.A.S. shall output separate signals to modulate the chilled water and heating water control valve actuators in sequence to maintain the space temperature within its operator adjustable heating and cooling setpoints. As the zone temperature rises, the fan will modulate from its minimum speed (determined by the TAB contractor) to its maximum speed. As the zone temperature falls below the heating setpoint the fan will run at a fixed speed (determined by the TAB contractor) and the hot water valve will modulate to maintain the space heating temperature setpoint.

Outside Air Control (Demand Control Ventilation) (AHU-D1-01 & AHU-E2-01)
When the air handler is running in the occupied mode, the O.A. damper control shall be enabled and a request to run shall be sent to the OAHU that supplies the unit with outside air. A CO_2 sensor mounted in various spaces as indicated on drawings, shall monitor the CO_2 level (see series fan powered box sequence). The B.A.S. shall modulate the outdoor air damper from its minimum position to its maximum position as required to maintain the CO_2 level between 850 ppm and 1,000 ppm (all adjustable). If the CO_2 level rises above 1,200 ppm an alarm shall be sent to the central site. OA dampers minimum and maximum positions shall be determined by the T.A.B. contractor to be the positions that allow the scheduled minimum and maximum OA CFM. The B.A.S. shall select the highest level when more than one CO_2 sensor is used to modulate the damper.

The outside air damper shall remain closed, and the OAHU shall remain off even during a scheduled occupancy time based on a global command from a shelter in place (building shutdown) button activation or based on a summer mode schedule. The dedicated OAHU will modulate fan speed to maintain duct static pressure.

Airflow Measuring Station
The outside airflow shall be measured by the flow measuring station and reported to the BAS. The BAS shall modulate the motorized damper for zone required outside air cfm per schedule or based on DCV requirement.

Outside Air Volume Control – AHU-D1-01
The BAS shall increase and decrease the outside airflow of the makeup air unit based on the number of exhaust devices in operation as follows:

All Hoods OFF: Outside Airflow = Demand Control Ventilation – Min. OA cfm.
1 Hood ON: Outside Airflow = Demand Control Ventilation – Min. OA cfm.
2 Hoods ON: Outside Airflow = 2,800 cfm
3 or more Hoods ON: Outside Airflow = 3,820 cfm

Space Humidity Control
A space humidity sensor, monitored by the B.A.S., shall set the cooling coil discharge air setpoint to 55^0F (adjustable) and modulate the chilled water valve to maintain the setpoint if the humidity rises above 60% (adjustable) and continue until it falls by 5% (adjustable). The B.A.S. shall modulate the hot water reheat valve to maintain the space temperature between its heating and cooling setpoints. If the B.A.S. control module is receiving a broadcast from the HW system that heating water is not available (see Heating Water System sequence of operations) the chilled water valve shall not be overridden until heating water is available. The fan will run at a fixed speed (determined by the TAB contractor) while in dehumidification mode.

Unoccupied Control
If the space temperature reaches the operator adjustable unoccupied setpoints of 55^0F (adjustable) heating and 95^0F (adjustable) cooling, the required equipment shall be started and run to maintain the space temperature within the setpoints. All values are operator adjustable.

If the space humidity reaches the operator adjustable unoccupied setpoints of 60% (adjustable), the required equipment shall be started and run to maintain the space humidity within the setpoints. All values are operator adjustable. Humidity setpoints supersedes the temperature setpoints. The BAS shall initiate an alarm if temperature or humidity rises above unoccupied setpoint.

Associated Equipment
During the occupied time period, the outside air damper shall be open. The exhaust fans associated with the air handler shall also be energized only during the occupied time period. The outside air dampers shall remain closed, the exhaust fans shall remain off, even during a scheduled occupancy time based on a global command from a shelter in place (building shutdown) button activation or based on a summer mode schedule. The Exhaust fans shall be commanded (off) during morning cool down / warm up and shall only turn on during the occupied time periods. General exhaust fans may require a separate schedule to accomplish this sequence and will be part of the commissioning sequence of operations to be demonstrated.

An airflow switch shall monitor the pressure across the air filter. A contact closure from the air filter switch will alarm and notify maintenance through the B.A.S. of a dirty filter.

Equipment OFF Conditions
When the air-handling unit is de-energized, its chilled water valve, hot water valve and OA damper shall be closed. The related exhaust fans shall be de-energized and the request to run to the OAHU shall be canceled. While the units are off if the outside air temperature falls below 34°F (operator adjustable) the chilled water valve and hot water valves shall be opened to 20% (adjustable) and the secondary pumps shall run for freeze protection.

10. SINGLE ZONE VAV AIR HANDLING UNITS WITH HUMIDITY CONTROL AND DX COIL (AHU-A2-01)

Equipment Control Points
Space Sensors – AI (Combo Temp & Humidity, without display)
Discharge Air Temperature – AI
Cooling Coil Discharge Air Temperature – AI
Cooling Coil (DX) Discharge Air Temperature – AI
Reheat HW Coil Discharge Air Temperature - AI
Fan Status – DI
Filter Status – DI
Air Handling Unit Fan Start/Stop – DO
Fan Speed Control – AO
Chilled Water Valve Control – AO
Hot Water Re-Heat Valve Control - AO
OA Damper Control – DO

DX Cooling Stages - DO (quantity to match AHU)
Freeze Stat – DI

AHU Activation
The air-handling unit shall have an occupancy/vacancy schedule, occupied heating/cooling setpoints and unoccupied heating/cooling setpoints assigned to it. As the occupancy time approaches, an optimum start/stop program shall calculate a start time based on current space temperature verses the occupied heating or cooling setpoint, assigned recovery rate, and outside air temperature -- all variables are operator assignable from the central site. The air-handling unit control program shall have the ability to learn its recovery rate whenever the operator enables the learning feature.

Fan Control
When the air handler is requested to run, the B.A.S. control module shall send an enable signal to the air handler inverter, which will energize the fan. A current switch shall prove status to the Building Automation System (BAS) and alarm the central site if the switch is not made within 20 seconds (operator adjustable). There shall also be a 10 second (operator adjustable) de-bounce time to prevent nuisance alarms. A run request shall be sent to the Chilled Water System when the air-handling unit is active, and cooling is required. A run request shall be sent to the Heating Water System when the air-handling unit is active, and heating is required. As the zone temperature rises, the fan will modulate from its minimum speed (determined by the TAB contractor) to its maximum speed. As the zone temperature falls below the heating setpoint the fan will run at a fixed speed (determined by the TAB contractor) and the hot water valve will modulate to maintain the space heating temperature setpoint.

Temperature Control
A wall mounted space temperature sensor shall monitor the air temperature in the space. The B.A.S. shall output separate signals to modulate the chilled water and heating water control valve actuators in sequence to maintain the space temperature within its operator adjustable heating and cooling setpoints. As the zone temperature rises, the fan will modulate from its minimum speed (determined by the TAB contractor) to its maximum speed. As the zone temperature falls below the heating setpoint the fan will run at a fixed speed (determined by the TAB contractor) and the hot water valve will modulate to maintain the space heating temperature setpoint.

After Hours Cooling
The air handling unit is furnished with a Hydronic Cooling coil and in addition a Direct Expansion (DX) coil with matching air-cooled condensing unit. When the system is operating after hours, the BAS shall utilize the DX cooling for supply air temperature control and shall not send a request to the chiller plant. If heating or dehumidification is requested after hours, request shall be sent to the boiler plant and BAS shall enable the boiler plant.

Space Humidity Control
A space humidity sensor, monitored by the B.A.S., shall set the cooling coil discharge air setpoint to 55^0F (adjustable) and modulate the chilled water valve or dx cooling stages to maintain the setpoint if the humidity rises above 60% (adjustable) and continue until it falls by 5% (adjustable). The B.A.S. shall modulate the hot water reheat valve to maintain the space temperature between its heating and cooling setpoints. If the B.A.S. control module is receiving a broadcast from the HW system that heating water is not available (see Heating Water System sequence of operations) the chilled water valve shall not be overridden until heating water is available. The fan will run at a fixed speed (determined by the TAB contractor) while in dehumidification mode.

Unoccupied Control
If the space temperature reaches the operator adjustable unoccupied setpoints of 55^0F (adjustable) heating and 95^0F (adjustable) cooling, the required equipment shall be started and run to maintain the space temperature within the setpoints. All values are operator adjustable.

If the space humidity reaches the operator adjustable unoccupied setpoints of 60% (adjustable), the required equipment shall be started and run to maintain the space humidity within the setpoints. All values are operator adjustable.

Humidity setpoints supersedes the temperature setpoints. The BAS shall initiate an alarm if temperature or humidity rises above unoccupied setpoint.

Associated Equipment
During the occupied time period, the outside air damper shall be open. The exhaust fans associated with the air handler shall also be energized only during the occupied time period. The outside air dampers shall remain closed, the exhaust fans shall remain off, even during a scheduled occupancy time based on a global command from a shelter in place (building shutdown) button activation or based on a summer mode schedule. The Exhaust fans shall be commanded (off) during morning cool down / warm up and shall only turn on during the occupied time periods. General exhaust fans may require a separate schedule to accomplish this sequence and will be part of the commissioning sequence of operations to be demonstrated.

An airflow switch shall monitor the pressure across the air filter. A contact closure from the air filter switch will alarm and notify maintenance through the B.A.S. of a dirty filter.

Equipment off Conditions
When the air-handling unit is de-energized, its chilled water valve, hot water valve and OA damper shall be closed. The related exhaust fans shall be de-energized.

Freeze Protection
A manual reset freeze stat mounted upstream of the cooling coil shall open the CHW control valves to 50% (adjustable) and HW control valves to 30% (adjustable), close the outside air damper, energize a secondary chilled water pump, a secondary hot water pump and boilers (see heating water sequence of operation), and alarm at the central site if the leaving air temperature drops to 34°F (locally adjustable). The freeze stat must be manually reset once the temperature rises above the trip point.

11. VARIABLE AIR VOLUME 100% OUTSIDE AIR HANDLING UNITS (OAHU-D1-01 & OAHU-E2-01)

Equipment Control Points
Discharge air temperature – AI
Discharge CHW Coil Air Temperature – AI
Preheat HW Coil Air Temperature – AI
Duct Static Pressure – AI
Air Handling Unit Fan Status – current switch - DI
Freeze Stat – DI
CHW Valve Control - AO
HW Pre-Heat Valve Control – AO
Fan Speed Control – AO
Outdoor Air Damper – DO
Damper End Switch – DI
Outdoor Air Handling Unit Start/Stop – DO
Static Pressure High Limit – DI
Filter Status – DI

Unit Activation
When the outdoor air handling unit is requested to run by an air handler it serves, the Building Automation System (B.A.S.) shall first open the outside air damper and the actuator's internal end switch will close when the damper is open allowing the outdoor air unit to be started. The B.A.S. shall send a signal to the outdoor air handling unit inverter, which will start the fan. A current switch shall

prove status to the B.A.S. and shall alarm at the central site if the switch is not made within 20 seconds (operator adjustable). There shall also be a 10 second (operator adjustable) de-bounce time to prevent nuisance alarms from a bouncing switch. The outdoor air damper shall be fully open before the outdoor air handling unit fan can be energized in either the hand or auto position.

Temperature Control
When the outdoor air handling unit is active, and heating is required a duct temperature sensor mounted downstream of the pre-heat coil will modulate the pre-heat valve to maintain the operator adjustable pre-heat discharge air temperature set point of 55^0F (adjustable). If cooling is required a duct temperature sensor mounted in the unit's supply air stream shall monitor the unit's supply air temperature and modulate the chilled water valve to maintain the operator adjustable discharge air temperature set point. The operator shall be able to select if the supply air cooling set point shall be reset based on the outside air temperature or use an operator adjustable set point of 55^0F. The outside air temperature reset schedule shall be a linear reset schedule with initial setpoints of 58^0F supply air at 60^0F outside air temperature and 55^0F supply air at 75^0F. The pre-heat control shall be disabled if the outside air temperature is greater than 55^0F and the supply air cooling control shall be disabled if the outside air temperature is less than 53^0F. All of the values shall be operator adjustable.

Freeze Protection
A manual reset freeze stat mounted in the discharge air stream of the pre-heating coil shall open the HW control valves to 30% and CHW control valves to 50% (adjustable), close the outside air damper, de-energize the outside air handling unit fan, energize a secondary chilled water pump, a secondary hot water pump and boilers (see heating water sequence of operation), and alarm at the central site if the leaving air temperature drops to 34°F (locally adjustable). The freeze stat must be manually reset once the temperature rises above the trip point.

Air Volume Control
The B.A.S. control module shall monitor the fan status and OA damper position of the AHU's that the OAHU serves. The TAB contractor shall balance the system to meet scheduled outside air CFM for each AHU and determine the OAHU's required duct static pressure to supply each AHU's scheduled OA CFM. The B.A.S. shall send a signal to the variable speed drive, which will adjust the fan speed to maintain the static pressure setpoint determined by the TAB contractor.

The static pressure shall reset to achieve a target damper setpoint of 85% with a 5% dead-band. Static pressure shall reset by not more than 0.2" W.C. every 3 minutes. Static pressure shall be a minimum of 0.5" W.C.

Associated Equipment
An airflow switch shall monitor the pressure across the air filter. A contact closure from the air filter switch will alarm and notify maintenance through the B.A.S. of a dirty filter.

Equipment OFF Conditions
When the outdoor air-handling unit is off, it's chilled and heating water valves shall be closed, and the outdoor air damper shall also be closed. If the outside air temperature drops below 34°F (operator adjustable), the B.A.S. shall open hot water valve to 30% and chilled water valves to 50% (adjustable).

12. CONSTANT AIR VOLUME 100% OUTSIDE AIR HANDLING UNITS (OAHU-A2-01, OAHU-B1-01, OAHU-C1-01 & OAHU-D1-02)

Equipment Control Points
Discharge air temperature – AI
Discharge CHW Coil Air Temperature – AI
Preheat HW Coil Air Temperature – AI
Air Handling Unit Fan Status – current switch - DI

Freeze Stat – DI
CHW Valve Control - AO
HW Pre-Heat Valve Control – AO
Fan Speed Control – AO
Outdoor Air Damper – DO
Damper End Switch – DI
Outdoor Air Handling Unit Start/Stop – DO
Static Pressure High Limit – DI
Filter Status – DI

Unit Activation
When the outdoor air handling unit is requested to run by an air handler it serves, the Building Automation System (B.A.S.) shall first open the outside air damper and the actuator's internal end switch will close when the damper is open allowing the outdoor air unit to be started. The B.A.S. shall send a signal to the outdoor air handling unit inverter, which will start the fan. A current switch shall prove status to the B.A.S. and shall alarm at the central site if the switch is not made within 20 seconds (operator adjustable). There shall also be a 10 second (operator adjustable) de-bounce time to prevent nuisance alarms from a bouncing switch. The outdoor air damper shall be fully open before the outdoor air handling unit fan can be energized in either the hand or auto position.

Temperature Control
When the outdoor air handling unit is active, and heating is required a duct temperature sensor mounted downstream of the pre-heat coil will modulate the pre-heat valve to maintain the operator adjustable pre-heat discharge air temperature set point of 55^0F (adjustable). If cooling is required a duct temperature sensor mounted in the unit's supply air stream shall monitor the unit's supply air temperature and modulate the chilled water valve to maintain the operator adjustable discharge air temperature set point. The operator shall be able to select if the supply air cooling set point shall be reset based on the outside air temperature or use an operator adjustable set point of 55^0F. The outside air temperature reset schedule shall be a linear reset schedule with initial setpoints of 58^0F supply air at 60^0F outside air temperature and 55^0F supply air at 75^0F. The pre-heat control shall be disabled if the outside air temperature is greater than 55^0F and the supply air cooling control shall be disabled if the outside air temperature is less than 53^0F. All of the values shall be operator adjustable.

Freeze Protection
A manual reset freeze stat mounted in the discharge air stream of the pre-heating coil shall open the HW control valves to 30% and CHW control valves to 50% (adjustable), close the outside air damper, de-energize the outside air handling unit fan, energize a secondary chilled water pump, a secondary hot water pump and boilers (see heating water sequence of operation), and alarm at the central site if the leaving air temperature drops to 34°F (locally adjustable). The freeze stat must be manually reset once the temperature rises above the trip point.

Associated Equipment
An airflow switch shall monitor the pressure across the air filter. A contact closure from the air filter switch will alarm and notify maintenance through the B.A.S. of a dirty filter.

Equipment OFF Conditions
When the outdoor air-handling unit is off, it's chilled and heating water valves shall be closed, and the outdoor air damper shall also be closed. If the outside air temperature drops below 34°F (operator adjustable), the B.A.S. shall open hot water valve to 30% and chilled water valves to 50% (adjustable).

13. HYDRONIC FAN COIL UNITS WITH RE-HEAT COIL (HUMIDITY CONTROL) (FCU-D1-01, FCU-D1-02, FCU-E1-05 & FCU-E1-07)

Equipment Control Points

Space Temperature – AI
Space Humidity - AI
Discharge Air Temperature – AI
Fan Status – DI
Chilled Water Valve – AO
Re-Heat Valve – AO
Fan Start/Stop – DO
Float Switch – DI
Outdoor Air Damper – DO

Zone Occupancy
Each unit shall have an occupancy/vacancy schedule, occupied heating/cooling setpoints and unoccupied heating/cooling setpoints assigned to it. As the occupancy time approaches, an optimum start/stop program shall calculate a start time based on current space temperature versus the occupied heating or cooling setpoint, assigned recovery rate, and outside air temperature -- all variables are operator assignable from the central site.

Fan Control
When the calculated start time arrives, the BAS shall energize the fan. A current switch shall prove status to the BAS and shall alarm at the central site if the switch is not made within 40 seconds (adjustable).

Space Temperature Control
A temperature sensor shall monitor the air temperature in the space. The BAS shall modulate the chilled water and hot water control valve, in sequence, to maintain the space temperature within setpoint.

Space Humidity Control
A humidity sensor shall monitor the humidity in the space. When there is a call for dehumidification, the BAS shall open the chilled water valve to maintain a 55°F cold deck temperature and shall modulate the reheat valve to maintain the occupied cooling & heating setpoint. If heating is not available dehumidification mode shall be deactivated.

Associated Equipment
A float switch shall monitor the moisture/water level in the drain pan. The unit shall shutdown when overflow is detected.

Unoccupied Control
During the unoccupied time period, if the space temperature reaches the unoccupied heating or cooling setpoints (55°F heating and 95°F cooling, adjustable) the required equipment shall be started and run as normal to maintain the space temperature within these setpoints.

Outside Air
When the unit is in occupied mode, the BAS controller shall open the outside air damper.

Equipment OFF Conditions
When the unit is off, the chilled water and hot water valves shall be closed.

14. HYDRONIC FAN COIL UNITS WITH RE-HEAT COIL (HUMIDITY CONTROL) (FCU-E1-01, FCU-E1-02, FCU-E1-03 & FCU-E1-04)

Equipment Control Points
Space Temperature – AI
Space Humidity - AI
Discharge Air Temperature – AI
Fan Status – DI

Chilled Water Valve – AO
Re-Heat Valve – AO
Fan Start/Stop – DO
Float Switch – DI
Outdoor Air Damper – DO
Airflow Measuring Station – AI

Zone Occupancy
Each unit shall have an occupancy/vacancy schedule, occupied heating/cooling setpoints and unoccupied heating/cooling setpoints assigned to it. As the occupancy time approaches, an optimum start/stop program shall calculate a start time based on current space temperature versus the occupied heating or cooling setpoint, assigned recovery rate, and outside air temperature -- all variables are operator assignable from the central site.

Fan Control
When the calculated start time arrives, the BAS shall energize the fan. A current switch shall prove status to the BAS and shall alarm at the central site if the switch is not made within 40 seconds (adjustable).

Space Temperature Control
A temperature sensor shall monitor the air temperature in the space. The BAS shall modulate the chilled water and hot water control valve, in sequence, to maintain the space temperature within setpoint.

Space Humidity Control
A humidity sensor shall monitor the humidity in the space. When there is a call for dehumidification, the BAS shall open the chilled water valve to maintain a 55°F cold deck temperature and shall modulate the reheat valve to maintain the occupied cooling & heating setpoint. If heating is not available dehumidification mode shall be deactivated.

Airflow Measuring Station
The outside airflow shall be measured by the flow measuring station and reported to the BAS. The BAS shall modulate the motorized damper to maintain constant volume outside air as scheduled.

Associated Equipment
A float switch shall monitor the moisture/water level in the drain pan. The unit shall shutdown when overflow is detected.

Outside Air
When the unit is in occupied mode, the BAS controller shall open the outside air damper.

Unoccupied Control
During the unoccupied time period, if the space temperature reaches the unoccupied heating or cooling setpoints (55°F heating and 95°F cooling, adjustable) the required equipment shall be started and run as normal to maintain the space temperature within these setpoints.

Equipment OFF Conditions
When the unit is off, the chilled water and hot water valves shall be closed.

15. FAN COIL UNIT – COOLING ONLY (MAIN ELECTRICAL ROOM) (FCU-E1-06)

Equipment Control Points
Space Temperature – AI
Discharge Air Temperature – AI
Fan Status – DI

Chilled Water Valve – AO
Fan Start/Stop – DO
Float Switch – DI

Zone Occupancy
The fan coil unit shall be in occupied mode at all times.

Fan Control
When the calculated start time arrives, the BAS shall energize the fan. A current switch shall prove status to the BAS and shall alarm at the central site if the switch is not made within 20 seconds (adjustable).

Space Temperature Control
A wall mounted space temperature sensor shall monitor the air temperature in the space. The BAS shall modulate the chilled water, in sequence, to maintain the space temperature within setpoint.

Associated Equipment
A float switch located in the auxiliary drain pan shall, when activated, shut down the unit.

Equipment off Conditions
When the unit is off, the chilled water and hot water valves shall be closed

16. DUCTLESS MINI-SPLIT-SYSTEM AIR CONDITIONERS - IDF/MDF ROOMS

The split systems shall have a factory furnished controller and operate stand-alone based on unit thermostat. The BAS shall monitor the space temp only. Thermostat provided by unit manufacturer and installed by BAS.

Equipment Control Points
Space Temperature – AI (monitoring only)

17. MINI-SPLIT-SYSTEM AIR CONDITIONERS WITH OUTSIDE AIR (FCU-B1-01, FCU-C1-01, FCU-D1-03, FCU-D1-04 & FCU-D1-05)

The split systems shall have a factory furnished controller and operate stand-alone based on unit thermostat. The BAS shall monitor the space temp only. Thermostat provided by unit manufacturer and installed by BAS.

Equipment Control Points
Space temperature – AI (monitoring only)
Outdoor air damper – DO
Float Switch – DI (Suspended Ducted Units Only)

Outside Air
When the unit is in occupied mode, the BAS controller shall open the outside air damper.

Equipment Off Conditions
When the unit is off, the outside air damper shall be closed. A float switch shall monitor the moisture/water level in the drain pan. The unit shall shutdown when overflow is detected.

18. VARIABLE SPEED DRIVES INTERFACE

Equipment Control Points
Start/Stop – DO
Alarm – DI
Last fault – AI

Reset – DO
% output – AI
Frequency output – AI
Speed – AI
Current – AI
Power – AI
Drive temperature – AI
KWh – AI
Runtime - AI

The BAS shall interface directly to each variable speed drive and report all information to the central site.

19. GENERAL EXHAUST FANS

Equipment Control Points
Exhaust Fan Status – DI
Exhaust Fan Enable – DO
Motorized Damper – DO (where indicated on drawings)

Interlock all general exhaust fans to run with air handling equipment serving the same area and run only during the occupied mode with their OA Dampers open. The exhaust fans shall remain off even during the scheduled occupancy time based on a global command from a shelter in place (building shutdown) button or based on a summer mode schedule. Where exhaust fans have associated motorized dampers (in-line exhaust fans), BAS contractor shall provide dampers and actuators and necessary interlock wiring to allow damper to open whenever the exhaust fan is running.

20. TWO SPEEDSCIENCE LAB EXHAUST FANS

Equipment Control Points
Purge Buttons – DI
Fan Status – DI
Fan Start/Stop – DO
Damper – DO

The BAS shall have an occupancy/vacancy schedule. Fan shall energize and run in low speed during occupancy schedule and only run with their exhaust dampers open. BAS shall monitor the fan status. Motorized dampers and actuators provided and installed by the BAS contractor and necessary interlock wiring to allow damper to open / close whenever the exhaust fan is ON / OFF.

The fan shall be activated to higher speed by a mushroom style momentary pushbutton, provided by the controls contractor. The pushbutton location shall be verified with owner and architect prior to installation. When the pushbutton is pressed, the fan shall be activated to higher speed for 15 minutes (adjustable) and return to normal speed after 15 minutes (adjustable). Pressing and holding the pushbutton for 5 seconds (adjustable), shall cancel the purge sequence.

21. KILN ROOM THERMOSTAT CONTOLLED IN-LINE EXHAUST FANS

Equipment Control Points
Fan status – DI

Provide a line-voltage cooling thermostat to energize fan whenever the space temperature increases above 80°F (adjustable) setpoint.

22. KITCHEN HOOD EXHAUST FANS / 100% OUTSIDE AIR MAKE-UP AIR UNIT

All controls devices external to units shall be provided by the make-up air unit manufacturer and installed by the control's contractor.

The Makeup Air Units (MAU) shall have a factory furnished controller with BACnet card. The BAS contractor shall furnish and install remote sensors and shall provide and install a BACnet interface and wiring. The BAS contractor shall coordinate with the unit manufacturer to ensure device compatibility with factory controller and sequences of operation meet specifications and to also discover and incorporate all available control points. MAU manufacturer shall verify software provided with the factory controller matches sequences of operation. The MAU manufacturer and the BAS contractor shall both commission the unit and verify operation. MAU shall be able to have all equipment control points available via BAS and **shall have read and write capability**.

Exhaust Fan Equipment Control Points
Exhaust Fan Status (each fan) - Current switch – DI
Exhaust Fan Enable – DO
Hood Status – DI

Make-Up Air Unit Equipment Control Points
Unit Start/Stop – DO (Hardwired to BAS)
Supply Air Temperature – AI (BACnet via BAS, installed by BAS contractor)
Supply Air Temperature Cooling & Heating Setpoints – (2) AO (BACnet via BAS)
Evaporator Coil Temperature – AI (BACnet via BAS)
Evaporator Coil Temperature Setpoint – AO (BACnet via BAS)
Outside air damper – AO (BACnet via BAS)
Gas Heating Capacity – AI (BACnet via BAS)
Clogged Filter – DI (BACnet via BAS)
MAU Alarm Status – DI (BACnet via BAS)
MAU fan status – current switch – DI (BACnet via BAS)
DX Cooling percent capacity – AI (BACnet via BAS)
Hot Gas Reheat Capacity – AI (BACnet via BAS)
Variable Frequency Drive Position – AI (BACnet to BAS)
Variable Frequency Drive Override – AO (BACnet via BAS)
HVAC Mode Override – AO (BACnet via BAS)
HVAC Mode Status – AI (BACnet via BAS)
Individual Compressor Status – DI (BACnet via BAS)
Individual Digital Compressor Status – AI (BACnet via BAS)
Compressor(s) head pressure – AI (BACnet via BAS)
Compressor(s) discharge temp – AI (BACnet via BAS)

The kitchen hood supply MAU and exhaust fans shall be interlocked to operate together. The hood fans shall be enabled to run by the BAS based on an operator assigned schedule. When the fans are enabled to run, they shall be controlled via a local switch mounted at the hood. Status of each hood will be monitored by the BAS. If exhaust hood is switched on, its associated exhaust fan shall turn on and makeup air damper shall open. Once open as determined by end-switch, the makeup air unit will be enabled.

The outside air temperature and relative humidity sensors shall control the MAU mode of operation. When the outside air temperature is above 55°F, the unit shall be placed in dehumidification priority mode. During dehumidification priority mode, the refrigeration capacity shall modulate to maintain the evaporator coil temperature setpoint of 50°F (adj.), and the hot gas reheat valve shall be modulated to maintain the supply air temperature cooling setpoint of 68°F (adj.). When the outside air temperature is below 55°F, the unit shall be placed in heating mode. During heating mode, the natural gas heater shall modulate to maintain the supply air temperature heating setpoint of 72ºF (adj.).

Equipment OFF Conditions
When the MAU is de-energized, the cooling and heating stages shall remain off and the outside air damper shall be fully closed.

23. DISHWASHER EXHAUST

Equipment Control Points
Exhaust/Supply Fan Status (each fan) - Current switch – DI

Interlock exhaust fan to operate when dishwasher is operating. Provide off delay to allow fan to run for 10 minutes (field adjustable) after dishwasher has been de-energized.

24. FREEZER/COOLER TEMPERATURE MONITORING AND ALARM

Equipment Control Points
Cooler temperatures – AI
Freezer temperatures – AI

The BAS contractor shall provide temperature sensors in the freezers and coolers. The BAS shall monitor the freezer and cooler temperatures and indicate the temperatures at the operator station. The BAS shall initiate an alarm if temperature rises above design and be sent to the computers, pagers, text message / compatible cell phone designated by district personnel. The BAS contractor shall set up trending information and reports per district standard. Coordinate with freezer/cooler manufacturer.

25. OUTDOOR AIR CONDITIONS

Equipment Control Points
Outdoor Air Temperature – AI
Outdoor Air Humidity - AI

The sensors shall be mounted in an area on the north side of the building where the representative temperature and humidity can be monitored, both shall have sun shields. Based on the outside air temperature and humidity the BAS shall calculate the outdoor enthalpy, wet bulb, and dew point temperatures. The outdoor air temperature and humidity shall be broadcast as global information for use by the other control programs.

26. HVAC TIMED LOCAL OVERRIDE (TLO)

Equipment Control Points
Override button input – DI

A local override button located as directed by the owner shall allow temporary override of the entire system. Each press of the button shall place the system in occupied mode for 30 minutes (adjustable), to a maximum of 2 hours (adjustable).

27. EMERGENCY BUILDING SHUTDOWN (SHELTER IN PLACE)

Equipment Control Points
Shutdown Switch Status – dry contact – DI
Provide a single mushroom style pushbutton adjacent to fire alarm control panel. Operation shall be pushbutton off, keyed switch on. Provide clear plastic cover to prevent accidental activation. Provide engraved identification tag with “Emergency HVAC Shutdown”. When activated, the BAS shall shut down the HVAC system and close all intake, exhaust, and relief dampers. The button must be

manually reset (via key) to allow the HVAC system to resume normal operation. Confirm location with owner/architect prior to installation.

28. OUTSIDE AIR INTAKE HOODS

Equipment Control Points
Damper Open/Close – DO

When the associated Air Handling Unit is in occupied mode, the BAS controller shall open the outside air damper. Damper and actuators provided by Intake Hood manufacturer, wiring and installation by BAS.

29. BUILDING RELIEF HOODS

Equipment Control Points
Isolation Damper OPEN / CLOSE - DO
Damper Position Status – DI

The BAS shall OPEN each motorized relief damper when the associated area is occupied. An internal Barometric damper shall OPEN/ CLOSE according to interior building air pressure.
Damper and actuators provided and installed by BAS.
In the event of a Shelter in Place shutdown all motorized Relief dampers shall be CLOSED.

30. COOL-DOWN CONTROL

ON-OFF: Prior to the start of the occupied mode, all air handling units shall be started and be controlled as specified except that the outside air dampers shall remain closed, and the exhaust fans shall be OFF. The duration of the cool-down cycle shall be regulated by the BAS optimum start/stop routine. The cool-down cycle shall continue until all space temperatures are at or below the setpoint. Cool-down cycle shall not be initiated when outside air temperature is less than 80°F.

31. WARM-UP CONTROL

ON-OFF: Prior to the start of the occupied mode, all air handling units shall be started and be controlled as specified except that the outside air dampers shall remain closed, and the exhaust fans shall be OFF. The duration of the warm-up cycle shall be regulated by the BAS optimum start/stop routine. The warm-up cycle shall continue until all space temperatures are at or above the setpoint. Warm-up cycle shall not be initiated when outside air temperature is greater than 70°F.

32. LOAD SHEDDING

Equipment Control Points
Enable – DI – Push Button

Provide load shedding capabilities via software. This should include setpoint relaxation, setpoint reset and shutdown of equipment. Coordinate equipment shutdown with the owner.

The user shall have the ability to have 8 levels of adjustment to reduce the electrical demand of the facility. Each level shall be schedulable, respond to a command from the electrical provider, and have a button for instant activation.

The user shall have the following configuration within each configurable level:

- Setpoint Relaxation
- Outside Air Shutdown

- Equipment Shutdown
- Chiller Plant State Limit
- Chiller Shutdown

Setpoint Relaxation will allow the setpoints to shift away from their current setpoint based on the amount specified in the active demand response level.

Outside Air Shutdown will deactivate the outside air equipment.

Equipment Shutdown will shut down the HVAC equipment.

Chiller Plant State Limit will limit the number of available states the chiller plant can use. A plant state of 0 will shut down the chiller plant.

Chiller Shutdown will shut down the chillers but allow the pumps to run maintaining differential pressure setpoint.

All equipment shall be configurable to ignore any or all demand response commands. The user shall have the ability to run a report to adjust each of these parameters.

The Demand Response dashboard shall display all levels and their configuration, the electrical demand of the facility, the current level of reduction scheduled, the button to enable each level, and the average reduction each level is able to achieve.

33. OPTIMAL STOP

The BAS shall initiate an Optimal Stop algorithm as the end of the schedule time period approaches. The optimal stop algorithm shall utilize the reduction in outside air, plant request, and setpoint relaxation. Outside air shutdown shall have a maximum shut-off time of 60 minutes (adjustable) prior to the end of time period. Plant request shutdown shall have a maximum shut-off time of 10 minutes (adjustable) prior to the end of time period. Setpoint relaxation shall have a maximum limit of 3°F over 45 minutes (adjustable).

One hour prior to end of schedule, the outside air shall shutdown and the setpoint relaxation shall reset 1°F (adjustable) every 15 minutes (adjustable). The equipment shall monitor the rate of change in the zones to determine when the plant request can be eliminated to finish the day without an impact to the zone temperatures.

34. UNIT HEATERS

Unit heaters shall be controlled by a factory furnished thermostat. BAS contractor shall install and wire thermostat.

35. INTERIOR / EXTERIOR LIGHTING CONTROL

Equipment Control Points
Lighting Contactor Enable/Disable - DO
Lighting controllers

The BAS contractor shall provide separate outputs for each contactor indicated on the electrical drawings. Each contactor shall be able to be controlled via operator defined schedule independently or in groups defined by the operator. Provide a photocell for monitoring by the BAS. Exterior lighting shall be turned off if the photocell senses light levels above a pre-determined limit.

Contractor shall program to allow the operator to select whether the system utilizes a boundary schedule and sunrise/sunset calculations. If the exterior lights are scheduled to operate, the operator

shall have the option to select to enable them for an adjustable time period before or after sunset and disable for and adjustable time period before or after sunrise.

Provide integration to lighting control system. Provide summary to show system status of lights and occupancy sensors.

36. POWER MONITORING

Equipment Control Points
KW Input – From Switchgear – BACnet Interface

The BAS shall connect to building electrical meter and monitor the buildings KWH usage. The B.A.S. control module shall show the current usage, monthly usage, year-to-date usage, and time and date of the highest peak demand for the month and year. Demand thresholds may be set to adjust set-points and shed loads in order to reduce peak consumption.

Sub Metering
The BAS shall interface to the sub meters provided and installed by the electrical contractor via BACnet MSTP protocol. Refer to electrical drawings for sub meter quantities and location. Display all available information at the BAS.

Alarming
The BAS shall provide alarm capabilities when power outages occur. All equipment necessary to accomplish sending alarms via email or text shall be on emergency power.

37. MISCELLANEOUS METERING / MONITORING

Water Metering, Fire & Irrigation
The main water meter entering the building, fire water & irrigation shall be monitored for usage. Meters shall be provided by the BAS and installed by the plumbing contractor. The BAS shall record historical data to include current gallons, gallons today, previous day, for the month and previous month, the year and previous year.

Natural Gas
The main natural gas meter to the building will send a pulse signal to the BAS. Meters shall be provided by the BAS and installed by the plumbing contractor. The BAS shall record historical data to include current gas usage, CF/Today, CF previous day, CF for the month and CF for the previous month, CF for the year and CF for the previous year.

38. ELECTRIC DUCT HEATER

Equipment Control Points
Supply Air Temperature Heating Setpoints – AO
Supply Air Temperature – AI
Electric Duct Heater Stages – AO (SCR)

Duct mounted electric heater shall modulate to maintain the room setpoint.

END OF SECTION 23 09 93

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot water heating piping.
2. Chilled water piping.
3. Condenser water piping.
4. Make-up water piping.
5. Condensate-drain piping.
6. Blowdown drain piping.
7. Air-vent piping.

B. Related Sections include the following:

1. Section 23 21 23 "Hydronic Pumps" for pumps, motors, and accessories for Hydronic piping.

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

1.4 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be 150 PSI pressure class unless otherwise noted or required by project conditions.

1.5 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Provide flanges, union, and couplings at locations requiring servicing.

B. Provide unions, flanges, and couplings downstream of valves and at equipment or apparatus connections.

C. Provide non-conducting dielectric connections whenever joining dissimilar metals in open systems.

D. Do not use direct welded or threaded connections to valves, equipment, or other apparatus.

1.6 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: For each type of the following:

1. Plastic pipe and fittings with solvent cement.

2. RTRP and RTRF with adhesive.

3. Pressure-seal fittings.

C. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops. The Pipe shop drawings shall be superimposed on the architectural backgrounds.

1. Grooved joint couplings and fittings shall be shown on drawings and product submittals and be specifically identified with the applicable manufacturer style or series number.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control test reports.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used.

E. Test Reports: Indicate results of refrigerant leak test and acid test.

F. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.8 QUALITY ASSURANCE

A. All pipe and accessories shall be of United States domestic manufacture.

B. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

C. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

E. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

F. Perform Work in accordance with ASME B31.5 code for installation of piping systems and ASME Section IX for welding materials and procedures.

G. Maintain one copy of each document on site.

H. All grooved joint piping products shall be supplied by a single domestic manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

I. Design piping systems under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.9 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Division 1 - General Requirements.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system Protect.

D. Contractor shall adequately protect piping from damage after delivery to the project. Piping shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

E. Do not deliver piping to the project site until progress of construction has reached the stage where piping is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

1.10 WELDING

A. Welding Procedures: Conform to latest recommendations of American Welding Society and Code for Pressure Piping, ANSI B31.1, and current edition. Welding and stress relieving procedures shall conform to Appendix, Section VI, and “Standard Qualifications for Welding Procedures, Welders and Welding Operators."

B. Locations for Welding: Welding shall not be permitted within occupied area of the building. When the building or a portion of the building is in use as a permanent occupancy welding shall be permitted only in areas physically separated from occupied spaces by fire rated or non-combustible walls to deck or on completely gutted and unoccupied floors.

C. Fire Protection and Smoke Venting: The Contractor shall provide all manpower and equipment required to protect the building structure and site occupants, other Contractors, etc., from hazards and to remove welding fumes from the building conform to the latest requirements of NFPA 51B.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type B).

B. Wrought-Copper Fittings: ASME B16.22.

1. Housing: Ductile Iron.
2. Gasket: EPDM, Grade EHP
3. Pipe Sizes 2” and larger
4. Tools: Manufacturer's grooving tools.
5. Minimum 300-psig working-pressure rating at 250 deg F.

C. Copper or Bronze Pressure-Seal Fittings:

1. Housing: Copper.
2. O-Rings and Pipe Stops: EPDM.
3. Pipe Sizes 2” and down
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F.

D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A53 Electric Resistance Weld (ERW), Type E, Grade B, Schedule 40 black steel with plain ends; application as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150.

D. Malleable-Iron Unions: ASME B16.39; Classes 150.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 250.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved End Joint Pipe Coupling: ASTM A53 Electric Resistance Weld (ERW), Type E, Grade B, Schedule 40 black steel with plain ends; application as indicated in Part 3 "Piping Applications" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Victaulic.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, and bolts to secure grooved pipe and fittings. Grooved piping system manufacturer shall be ISO 9001 approved.

3. Couplings: Grooved mechanical Installation ready couplings manufactured of a two segment, ASTM A 536, Grade 65-45-12 ductile iron cast housing. Gaskets shall be pressure responsive synthetic rubber, and pre-injected with lubricant, grade EHP or to suit intended service, conforming to ASTM D-2000. Gaskets shall be rated for 250 degrees Fahrenheit and made by grooved manufacturer. Grooved couplings shall be provided “Installation-Ready”; pre-assembled and pushed onto grooved pipe end, joined by second grooved pipe end, and then bolts and nuts are tightened down (no loose parts during installation). Coupling bolts shall be zinc plated heat-treated carbon steel track head conforming to ASTM A-183.

   a. Sizes up to 12”: Rigid Type, Style 107; Flexible Type, Style 177.
   b. Sizes 14” and larger: Rigid Type, Style W07; Flexible Type, Style W77.

4. Flange Adapters for grooved systems, Style 741/743 or W741.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 PLASTIC PIPE AND FITTINGS

A. CPVC Plastic Pipe: ASTM F 441/F 441M, Schedule 80, plain ends as indicated in Part 3 "Piping Applications" Article.

B. CPVC Plastic Pipe Fittings: Socket-type pipe fittings; ASTM F 439 for Schedule 80 pipe.

C. PVC Plastic Pipe: ASTM D 1785, Schedule 80, plain ends as indicated in Part 3 "Piping Applications" Article.

D. PVC Plastic Pipe Fittings: Socket-type pipe fitting; ASTM D 2467 for Schedule 80 pipe.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.

a. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Charlotte Pipe and Foundry Company.
b. IPEX Inc.
c. KBi.

2. CPVC one-piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.

B. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Charlotte Pipe and Foundry Company.
b. IPEX Inc.
c. KBi.
d. NIBCO INC.

2. MSS SP-107, CPVC union. Include brass or copper end, Schedule 80 solvent-cement-joint end, rubber gasket, and threaded union.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International Ltd.
e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 150 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 150 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Non-conducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or Phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elster Perfection.
b. Matco-Norca, Inc.
c. Precision Plumbing Products, Inc.
d. Victaulic Company.

2. Description:

a. Standard: IAPMO PS 66
b. Electroplated steel nipple. Complying with ASTM F 1545.
c. Pressure Rating: 300 psig 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot water heating, chilled water, and condenser water above ground, NPS 2 and smaller, shall be the following:

1. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot water heating, chilled water, and condenser water piping, above ground, NPS 2-1/2 and larger, shall be one of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings – **Central Plant only.**

C. Makeup-water piping installed aboveground shall be the following:

1. ASTM B 88, Type K (ASTM B 88M, Type B) hard drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

D. Condensate-Drain Piping: ASTM B 88, Type K (ASTM B 88M, Type B) hard drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

E. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blow-down drain is installed.

F. Air-Vent Piping:

1. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 23 05 23 "General-Duty Valves for HVAC Piping."

Q. Install unions in piping**,** NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Section 23 05 16 "Expansion Fittings and Loops for HVAC Piping."

U. Install lateral bracing with pipe hangers and supports to prevent swaying.

V. Identify piping as specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

A. Install mechanical sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for mechanical sleeve seals specified in Section 23 05 29 - “Hangers and Supports for HVAC Piping and Equipment”.

B. Sleeve pipe passing through partitions, walls, and floors. Refer to Section 23 05 29 – “Hangers and Supports for HVAC Piping and Equipment”.

C. Provide access doors where valves and fittings are not accessible.

D. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

E. Provide unions or flanges and isolation valves at each connection to a piece of equipment or control valve; accessory which requires removal for maintenance. Screwed unions should be used for two (2) inches IPS and smaller. Locate joints where they can be accessed for repair. Screw or flanged joints shall not be permitted above inaccessible ceilings or in chases.

F. All piping shall be installed to eliminate traps and pockets. Where air pockets or water trap cannot be avoided, provide means for drainage with valved hose connections for water trap and air vents for air pockets. Provide drain valves at low points of the system.

G. For pipe inside building, install parallel to lines of building, close to columns and walls vertical pipe shall be truly vertical. Spring or forcing piping into place will not be permitted. Install pipe to prevent strain on equipment connections.

H. Provide adequate access to all equipment, motorized valves, instruments, controls, and access panels.

I. Allow easy draining of water piping, with drain valves at low points.

3.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

F. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

H. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

J. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Non-pressure Piping: Join according to ASTM D 2855.

K. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

L. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.4 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Section 230519 "Meters and Gages for HVAC Piping."

3.5 FIELD QUALITY CONTROL

A. Prepare Hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, un-insulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush Hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on Hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.

3. Isolate expansion tanks and determine that Hydronic system is full of water.

4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least one hour, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.

2. Inspect pumps for proper rotation.

3. Set makeup pressure-reducing valves for required system pressure.

4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).

5. Set temperature controls so all coils are calling for full flow.

6. Inspect and set operating temperatures of Hydronic equipment, such as boilers, chillers, cooling towers, to specified values.

7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. In-line circulators
2. Split-Coupled Vertical In-line pumps
3. Automatic Condensate Pump Units

B. Related Sections:

1. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment - Mechanical Vibration Control: Product requirements for vibration isolators required with pumps.

1.3 REFERENCES

A. Underwriters Laboratories Inc.:

1. UL 778 - Motor Operated Water Pumps.

1.4 PERFORMANCE REQUIREMENTS

A. Provide pumps electrical characteristics in accordance with Division 26 and schedules on Drawings.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 and Section 23 05 00.

B. Provide line-by-line specification review annotated to certify compliance or deviation.

C. Product Data: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Provide parallel pump curves indicating the non-overloaded motor horsepower for single pump operation when applicable. Include NPSH curve with operating point plotted when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes, and finishes.

D. Shop Drawings: For each pump.

1. Show pump layout and connections.

2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

3. Include diagrams for power, signal, and control wiring.

E. Manufacturer's Installation Instructions: Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit hanging and support requirements and recommendations.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Submit in accordance with Division 1, General Requirements.

B. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.7 WARRANTY

A. Furnish one (1) year manufacturer parts and labor warranty for pumps. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start up will not be acceptable.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Spare materials shall be provided by equipment manufacturer and not by the installing mechanical contractor.

1. Furnish one (1) set of mechanical seals for each pump installed.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Pumps shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer’s protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect

the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

1.11 PUMP IDENTIFACTION REQUIREMENTS

A. Furnish each pump with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:

- Unit identification as indicated within Contract Documents.
- Serial Number.
- Model Number.
- Flow rate (GPM) and head (ft. H20).
- Motor Horsepower.
- RPM
- Power Supply: Volts / PH / Amps.
- Sales Order #.
- Date of unit manufactured.

B. For chilled water pumps, in addition to the base mounted identification tag provide an additional identification tag shipped loose for contractor to install on external rigid insulation board.

PART 2 – PRODUCTS

2.1 IN-LINE CIRCULATORS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Pentair / Aurora.
2. Armstrong.
3. Bell & Gossett.

B. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 175 psig maximum working pressure.

C. Casing: Cast iron, with flanged pump connections.

D. Impeller: Cast bronze, dynamically balanced and keyed to shaft.

E. Bearings: Two, oil lubricated bronze sleeves.

F. Shaft: Stainless steel with copper or bronze sleeve, integral thrust collar.

G. Seal: Carbon rotating against stationary ceramic seat, 212 degrees Fahrenheit maximum continuous operating temperature.

H. Drive: Flexible coupling.

I. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.2 "SPLIT-COUPLED" VERTICAL IN-LINE PUMPS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Pentair / Aurora
2. Armstrong.
3. Bell & Gossett.

B. Type: Vertical s haft, single stage, direct connected, radial split casing, for 175 psig maximum working pressure.

C. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connections with factory installed seal flush line, recessed cast iron drain pan with threaded connection for field piping to drain, flanged suction and discharge.

D. Impeller: 316 stainless steel, fully enclosed, dynamically balanced, and keyed to shaft.

E. Bearings: Grease or permanently lubricated roller or ball bearings. Bearings shall have 40,000-hour minimum life.

F. Shaft: 416 stainless steel with stainless steel shaft sleeve.

G. Mechanical Seals: Stainless steel multi-spring outside balanced type with a Viton secondary seal, carbon rotating face and Silicon Carbide stationary seat. Provide 316 stainless steel gland plate with factory installed flush line with manual vent, 225 degrees Fahrenheit maximum continuous operating temperature.

H. Drive: Axially split, spacer type rigid coupling constructed of high tensile aluminum bar with OSHA approved coupling guard.

I. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

a. Enclosure: Outdoors: Totally enclosed, fan cooled (TEFC).
b. Enclosure: Indoors: Open Drip Proof (ODP).
c. Efficiency: Premium efficient.
d. NEMA Design: MG-1.
e. Service Factor: 1.15.

2.3 AUTOMATIC CONDENSATE PUMP UNITS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Beckett Corporation
2. Hartell Pumps
3. Little Giant Pump Co.
4. Mepco, LLC.

B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory or field-installed check valve and a 72-inch minimum, electrical power cord with plug.

2.4 PUMP SUCTION DIFFUSER

A. Not applicable – shall be part of pump isolation drop, coordinate with Victaulic. Coordinate suction diffuser size with Victaulic for seamless connection. Refer to 23 05 23; 2.2 for further information.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide pumps to operate at specified system fluid temperatures and scheduled capacities. Pumps shall operate without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories. Provide no less than the minimum as required by the manufacturer.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping

D. Equipment Mounting: Install base-mounted pumps on cast-in-place concrete equipment bases.

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct bases to withstand, without damage to equipment, seismic force required by code.

3. Construct concrete bases 4 high and extend base not less than 6 inches in all directions beyond the maximum dimensions of base-mounted pumps unless otherwise indicated or unless required for seismic-anchor support.

4. Install base mounted pumps on concrete inertia base “RBMK” with spring isolators. Refer to section 23 05 48.

E. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers of size required to support weight of in-line pumps.

1. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

2. Comply with requirements for hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

F. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled, split coupled vertical in-line or base mounted pumps; install supports under elbows on pump suction and discharge line sizes four (4) inches and over.

G. Provide air cock and drain connection on horizontal pump casings.

H. Provide drains for bases and seals. Route to floor drain.

I. Lubricate pumps before start-up according to manufacturer’s instructions.

3.3 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to pump, allow space for service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Discharge side of pumps install non-slam check valve, combination shut-off butterfly valve and throttling valve with memory stop, and thermometer.

F. Suction side of pumps install suction diffuser with type 304 stainless steel strainer, shut-off butterfly valve on suction side of pumps and thermometer.

G. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping or install single gage with multiple-input selector valve.

3.4 STARTUP SERVICE

A. Start up service shall be performed by a factory authorized direct service technician. Start up work shall not be performed by installing mechanical contractor.

1. Complete installation and startup checks according to manufacturer's written instructions.

    a. Check piping connections for tightness.

    b. Clean strainers on suction piping.

    c. Perform the following startup checks for each pump before starting:

        1. Verify bearing lubrication.

        2. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

        3. Verify that pump is rotating in the correct direction.

    d. Prime pump by opening suction valves and closing drains and prepare pump for operation.

    e. Start motor.

    f. Open discharge valve slowly.

3.5 DEMONSTRATION

A. Demonstration shall be performed by a factory authorized direct service technician. Demonstration shall not be performed by installing mechanical contractor.

1. Train owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

2. Provide documentation of owner training in close out submittal.

END OF SECTION 23 21 23

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Refrigerant piping.
2. Unions, flanges, and couplings.
3. Refrigerant moisture and liquid indicators.
4. Valves.
5. Refrigerant strainers.
6. Refrigerant pressure regulators.
7. Refrigerant pressure relief valves.
8. Refrigerant filter-driers.
9. Refrigerant solenoid valves.
10. Refrigerant expansion valves.
11. Electronic expansion valves.
12. Refrigerant receivers.

B. Related Sections:

1. Section 31 00 00 - Earthwork: Earthwork for backfill in trenches.
2. Section 31 23 16.13 – Trenching and Backfilling: Execution requirements for trenching and backfilling required by this section.
3. Section 07 84 00 - Firestopping: and Fire Safing Product requirements for firestopping for placement by this section.
4. Section 08 31 13 - Access Doors: Access doors for concealed valves and accessories.
5. Section 09 91 00 - Painting and Staining: Product requirements for painting for placement by this section.
6. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports and sleeves for placement by this section.

7. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolation for placement by this section.

8. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.

9. Section 23 07 19 - HVAC Piping Insulation: Product requirements for Piping Insulation for placement by this section.

10. Section 23 21 13 - Hydronic Piping: Piping materials for refrigerant systems.

1.3 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 495 - Refrigerant Liquid Receivers.

2. ARI 710 - Liquid-Line Driers.

3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.

4. ARI 750 - Thermostatic Refrigerant Expansion Valves.

5. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. American Society of Mechanical Engineers:

1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.

3. ASME B31.5 - Refrigeration Piping.

4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. ASTM International (ASTM):

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

3. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

5. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

2. AWS D1.1 - Structural Welding Code - Steel.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

G. Underwriters Laboratories Inc.:

1. UL 429 - Electrically Operated Valves.

1.4 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

B. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.5 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

C. Provide pipe hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

D. Provide receivers sized to accommodate pump down charge.

E. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.6 SUBMITTALS

A. Submit in Accordance with Division 1 - General Requirements.

B. When manufacturer's cut sheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show specific pertinent performance data and quantities appropriate to scope of work.

C. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.

D. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories.

2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

3. Hangers and Supports: Submit manufacturers catalog information including load capacity.

4. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:

a. Refrigerant moisture and liquid indicators.

b. Refrigerant strainers.

c. Refrigerant pressure regulators.

d. Refrigerant pressure relief valves.

e. Refrigerant filter-driers.

f. Refrigerant solenoid valves.

g. Refrigerant expansion valves.

h. Electronic expansion valves.

E. Test Reports: Indicate results of piping system pressure test.

F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

G. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

H. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves, equipment and refrigerant accessories.

B. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.8 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years experience.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three (3) years experience approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Division 1- General Requirements.

B. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

C. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

F. Contractor shall adequately protect material from damage after delivery to the project. Piping shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

G. Do not deliver Piping to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

1.11 WARRANTY

A. Furnish five (5) year manufacturer warranty for valves excluding packing.

1.12 MAINTENANCE MATERIALS

A. Furnish two (2) refrigerant oil test kits each containing everything required for conducting one test.

1.13 EXTRA MATERIALS

A. Furnish two (2) packing kits for each size and valve type.

B. Furnish two (2) refrigerant filter-dryer cartridges of each type.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B 280, Nitrogenized Type L - ACR hard drawn.

1. Wrought-copper Fittings: ASME B16.22.

2. Brazing Filler Metals: AWS A5.8. BCuP: minimum 15% silver (Ag), 5% phosphorous (P), and balance copper (Cu).

3. Final product composition shall be 99% pure copper and lead free.

4. Provide in 10 ft. and 20 ft. straight tube lengths.

5. **Bendable pipe of any kind shall not be accepted.**

2.2 UNIONS, FLANGES, AND COUPLINGS

A. Two (2) inches and Smaller:

1. Copper Pipe: Bronze, soldered joints.

B. 2-1/2 inches and Larger:

1. Copper Piping: Bronze
.
2. Gaskets: 1/16-inch-thick preformed neoprene.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 REFRIGERANT MOISTURE AND LIQUID INDICATORS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division

3. Sporlan Valve Co.

B. Indicators:

1. Port: Single, UL listed.
2. Body: Brass, solder ends.
3. Sight glass: Color-coded paper moisture indicator with removable element cartridge and plastic cap.
4. Maximum working pressure: 500 psig
5. Maximum working temperature: 200 degrees Fahrenheit.

2.4 VALVES

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division
3. Sporlan Valve Co.

B. Diaphragm Packless Valves:

1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
2. Phosphor bronze and stainless-steel diaphragms, rising stem and hand wheel.
3. Stainless steel spring, nylon seats, disc with positive back seating.
4. Maximum working pressure: 500 psig
5. Maximum working temperature: 275 degrees Fahrenheit.

C. Packed Angle Valves:

1. Forged brass, solder ends.
2. Forged brass seal caps with copper gasket, rising stem and seat with back seating, molded stem packing.
3. Maximum working pressure: 500 psig
4. Maximum working temperature: 275 degrees Fahrenheit.

D. Ball Valves:

1. Two piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered ends.
2. Maximum working pressure: 500 psig and

3. Maximum working temperature: 300 degrees Fahrenheit.

E. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, solder ends.

2. Maximum working pressure: 500 psig.

F. Refrigerant Check Valves:

1. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

a. Alco Controls Div, Emerson Electric Co.

b. Parker Hannifin Corp., Refrigeration & Air Conditioning Division

c. Sporlan Valve Co.

2. Globe Type:

a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless-steel spring, Teflon seat disc.

b. Maximum working pressure: 500 psig.

c. Maximum working temperature: 300 degrees Fahrenheit.

3. Straight Through Type:

a. Spring, neoprene seat.

b. Maximum working pressure: 500 psig.

c. Maximum working temperature: 250 degrees Fahrenheit.

2.5 REFRIGERANT STRAINERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division

3. Sporlan Valve Co. Model.

B. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless-steel wire or monel reinforced with brass.

2. Maximum working pressure: 430 psig.

2.6 REFRIGERANT PRESSURE REGULATORS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division

3. Sporlan Valve Co.

B. Brass body, stainless steel diaphragm, pilot operated with remote pressure pilot, adjustable over 0 to 80 psig range, for maximum working pressure of 450 psig.

2.7 REFRIGERANT PRESSURE RELIEF VALVES

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division.

3. Sporlan Valve Co.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; setting selected to ASHRAE 15.

2.8 REFRIGERANT FILTER-DRIERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division

3. Sporlan Valve Co.

B. Replaceable Cartridge Angle Type:

1. Shell: ARI 710, UL listed, steel, removable cap, for maximum working pressure of 500 psig, and wrought copper fittings for solder end connections.

2. Filter Cartridge: Pleated media with integral end rings, stainless steel support.

3. Filter/Dryer Cartridge: Pleated media with solid core sieve with activated alumin to provide micronic filtration.

4. Wax Removal Cartridge: Molded bonded core of activated charcoal with integral gaskets.

C. Permanent Straight Through Type:

1. ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psig.

2. Permanent filter element shall be molded felt core surrounded by a desiccant for removal of acids and moisture for refrigerant vapor.

2.9 REFRIGERANT SOLENOID VALVES

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division

3. Sporlan Valve Co.

B. Valve: ARI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly, integral strainer, solder ends; for maximum working pressure of 500 psig. Stem designed to allow manual operation in case of coil failure.

C. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color-coded lead wires, integral junction box.

2.10 REFRIGERANT EXPANSION VALVES

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrigeration & Air Conditioning Division

3. Sporlan Valve Co.

B. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum ten (10) degrees Fahrenheit superheat. Select to avoid being undersized at full load and oversized at part load.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls, and floors. Refer to Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

E. Install pipe identification in accordance with Section 23 05 53 - Identification for HVAC Piping and Equipment.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Arrange refrigeration piping to return oil to compressor. Provide traps and loops in piping, and where necessary provide double risers. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide access where valves and fittings are not exposed.

I. Flood refrigerant piping system with nitrogen when brazing.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

K. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 91 00.

L. Install valves with stems upright or horizontal, not inverted.

M. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

N. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

O. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

P. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

Q. Provide electrical connection to solenoid valves.

R. Fully charge completed system with refrigerant after testing.

S. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

T. Install refrigerant piping in accordance with ASME B31.5.

U. Install piping in as short and direct arrangement as possible to minimize pressure drop.

V. Install piping with minimum number of joints using as few elbows and other fittings as possible.

W. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.

X. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.

Y. Insulate suction lines. Liquid lines are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.

1. Do not install insulation until system testing has been completed and all leaks have been eliminated.

2. Insulation shall be Armaflex Ultra pipe insulation. Provide 1-inch insulation thickness. All seams and joints shall be adhered and sealed using Armaflex 520 adhesive. All fittings shall be insulated with same insulation thickness as straight pipe.

3. **Exposed refrigerant liquid and suction piping (located indoors and/or outdoors)**: shall be insulated and include two (2) coats of WB Armaflex Finish. In addition, liquid and suction lines shall be provided with aluminum jacketing; provide 0.016-inch Type 3105 on all exterior insulated piping. Fitting covers shall be 0.024-inch Type1100 aluminum. Jacketing and fitting covers shall be banded with 0.20-inch Type 3105, 1/2-inch-wide banding with 0.32-inch Type 5005 wing seals on 12-inch centers.

Z. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.

AA. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

BB. Slope refrigerant piping as follows:

1. Install horizontal hot gas discharge piping with 1/2 inch per ten (10) feet downward slope away from the compressor.

2. Install horizontal suction lines with 1/2 inch per ten (10) feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.

3. Install traps and double risers where indicated, and where required to entrain oil in vertical runs.

4. Liquid runs

CC. Use fittings for all changes in direction and all branch connections.

DD. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

EE. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

FF. Conceal all pipe installation in walls, pipe chases, utility spaces, above ceilings, below grade floors, unless indicated to be exposed to view.

GG. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with one (1) inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

HH. Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing or valves.

II. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than six (6) inches shall be steel; pipe sleeves six (6) inches and larger shall be sheet metal.

JJ. Fire Barrier Penetrations: Seal pipe penetrations through fire rated wall, partitions, ceilings, and floors, maintain the fire rated integrity.

KK. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

LL. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

MM. Install moisture / liquid indicators in liquid lines between filter / driers and thermostatic expansion valves and in liquid line to receiver.

1. Install moisture / liquid indicators in lines larger than 2-1/8-inch OD, using a bypass line.

NN. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

OO. Install flexible connectors at the inlet and discharge connection of compressors.

3.3 INSTALLATION - REFRIGERANT SPECIALTIES

A. Refrigerant Liquid Indicators:

1. Install line size liquid indicators in main liquid line downstream of condenser.

2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.

3. Install line size liquid indicators downstream of liquid solenoid valves.

4. Install liquid indicator on leaving side of filter-driers.

B. Refrigerant Valves:

1. Install service valves on compressor suction and discharge.

2. Install gage taps at compressor inlet and outlet.

3. Install gage taps at hot gas bypass regulators, inlet, and outlet.

4. Install check valves on compressor discharge.

5. Install check valves on condenser liquid lines on multiple condenser systems.

6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.

C. Strainers:

1. Install line size strainer upstream of each automatic valve.

2. Where multiple expansion valves with integral strainers are used, install single main liquid-line strainer.

3. On steel piping systems, install strainer in suction line.

4. Install shut-off valves on each side of strainer.

D. Install pressure relief valves on ASME receivers. Install relief valve discharge piping to terminate outdoors.

E. Filter-Dryers:

1. Install permanent filter-dryers in low temperature systems.

2. Install permanent filter-dryer in systems containing hermetic compressors.

3. Install replaceable cartridge filter-dryer vertically in liquid line adjacent to receivers.

4. Install replaceable cartridge filter-dryer upstream of each solenoid valve.

F. Solenoid Valves:

1. Install in liquid line of systems operating with single pump-out or pump-down compressor control.

2. Install in liquid line of single or multiple evaporator systems.

3. Install in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Comply with the procedures contained in the AWS: Brazing Manual".

1. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.

2. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.

B. Pressurize the pipe and fittings during brazing with nitrogen to prevent formation of harmful oxides.

C. Heat joints using-acetylene torch. Heat to proper and uniform brazing temperature.

3.5 VALVE INSTALLTIONS - GENERAL

A. General: Install refrigerant valves in accordance with manufacturer's instructions.

B. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.

C. Install a full sized, 3-valve bypass around each drier.

D. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at the top.

1. Coordinate electrical requirements and connections.

E. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.

1. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.

2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.

3. Secure the bulb straps. Do not mount build in a trap or at the bottom of the line.

4. Where external equalizer lines are required make the connection where it clearly reflect the pressure existing in the suction line at the bulb location.

F. Install pressure regulating and relieving valves required by ASHRAE Standard 15.

3.6 EQUIPMENT CONNECTIONS

A. Install piping adjacent to machine to allow servicing and maintenance.

3.7 FIELD QUALITY CONTROL

A. Install, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.

B. Repair leaking joints using new materials and retest for leaks.

3.8 CLEANING

A. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedures:

1. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing by means of a wire or an electrician's tape.

2. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.

3. Draw a clean, lintless cloth saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint.

4. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

3.9 ADJUSTING AND CLEANING

A. Verify actual evaporator applications and operating conditions and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.10 SYSTEM CHARGING

A. Charge system using the following procedure:

1. Install core in filter dryer after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 microns. When vacuum holds for a minimum of 24 hours, system is ready for charging.

3. During excavation, apply heat to pockets, elbows, and low spots in piping.

4. Break vacuum with refrigerant gas, allow pressure to build up to 2 psig.

5. Charge system with a new filter-dryer core in charging line.

B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, trouble shooting, servicing, and preventive maintenance of refrigerant piping valves and refrigerant piping specialties.

C. Review data in Operating and Maintenance Manuals.

D. Schedule training with Owner with at least seven (7) days advance notice.

END OF SECTION 23 23 00

SECTION 23 25 13 - WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

B. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

C. The Common Work Results for HVAC, Section 23 05 00, are included as a part of this Section as though written in full in this document.

1.3 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.4 DESCRIPTION OF WORK

A. Work Included: Perform water analysis and provide all water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to control water quality for each system specified hereinafter as follows:

1. Chilled Water Systems
2. Heating Water Systems

B. Chemicals: Provide, at no additional cost to the Owner, all chemicals required for operating and testing all water treatment systems prior to and for three months after acceptance by the Owner.

C. Instructions: Provide operating and maintenance instructions for each water treatment system; include one set in each Owner's Manual and deliver one set to Owner's operating personnel.

D. Testing Equipment and Reagents: Furnish suitable water treatment equipment for each system, complete with apparatus and reagents necessary for operation prior to and for three months after acceptance by the Owner.

E. Service Representative: Furnish the services of a qualified service representative to instruct Owner's operating personnel in proper operation and maintenance of water treatment equipment, systems and tests required. Service representative shall return to the site bi-weekly during first 2 months of operation and monthly during the remainder of the guarantee period. At such time, service representative shall check and adjust water treatment system operation, check efficiency of chemicals and chemical applications, and instruct and advise operating personnel.

F. Replacement and Rework: Replace defective or nonconforming materials and equipment with new materials and equipment at no additional cost to the Owner for 1 year after successful start-up of the system. All warranty work shall be FOB as installed at the project site.

1. Guarantee: Provide system produced by manufacturer who is willing to execute the required guarantee.

2. Agreement to Maintain: Provide system produced by manufacturer who is willing to execute (with the Owner) the required agreement for continued maintenance of the system.

1.5 QUALITY ASSURANCE

A. Qualifications: The Contractor for work under this Section shall have:

1. Research and development facilities.

2. Regional laboratories capable of making water analysis.

3. A service department and qualified technical service representative located within a reasonable distance of the project site.

4. Service representatives who are Registered Engineers of factory-certified technicians with not less than 5 years of water treatment experience with the water treatment system manufacturer.

B. Packaging and Labeling: Supply water treatment chemicals in metal drums, fiber drums with plastic liners, or plastic lined "liqui-paks" as best suited to the materials. Paper bags or unlined cardboard cartons will not be acceptable. Use only chemicals in domestic water systems, all coincides regardless of where used, which are registered with the U.S. Department of Agriculture (USDA) or the U.S. Environmental Protection Agency (EPA) and which are labeled as required by law.

C. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories (UL) and which comply with National Electrical Manufacturers' Association (NEMA) standards.

D. Chemical Standards: Provide chemical products acceptable under state and local pollution control or other governing regulations.

1.6 SUBMITTALS

A. Test reports: Submit test reports certified by an officer of the firm, on water treatment company letterheads, of samples of each treated water system specified. Comply with ASTM D 596 for reporting. Indicate the ASTM best methods for each test.

B. Shop Drawings: Submit shop drawings for each water treatment system. Show wiring, piping, and tubing sizes, fittings, accessories, valves and connections.

C. Guarantee: Submit written guarantee signed by the Manufacturer and countersigned by the Installer and Contractor, agreeing to adjust or replace the chemicals in the systems as required achieving the required performance, during a 1-year period following the final start-up or the continued operation of the chillers.

D. Agreement to Maintain: Prior to the time of final acceptance, the Manufacturer of the chilled water treating system shall submit four copies of an "Agreement for Continued Service and the Owner's possible acceptance." Offer terms and conditions for furnishings chemicals and providing continued testing and equipment for a 1-year period with option for renewal of the Agreement by Owner.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Nalco

2. Precision Water Technologies

2.2 GENERAL

A. Water Analysis: Determine which chemicals to use from the results of a water sample analysis taken from the building site by the system manufacturer. Provide ingredients necessary to achieve the desired water conditions.

B. **Pre-Treatment: For Flushing and Cleaning of Hydronic Piping, refer to specification section 23 25 19. Flushing and Cleaning of Hydronic Piping shall be performed by PurgeRite.**

C. FDA and USDA Approval: use only FDA and USDA-approved products in system with direct connection to domestic water systems.

D. Governing Laws: Ensure that neither products, waste, blow-down nor other effluents violate local, state, EPA, or other agency regulations in effect in the project area.

2.3 CHILLED AND HEATING WATER SYSTEMS

A. Chemicals: Provide water treatment products which contain inhibitors that perform the following:

1. Form a protective film to prevent corrosion and scale formation to maintain iron levels between 0.0 and 0.5 as Fe.

2. Scavenge oxygen and protect against scale

3. Remain stable throughout operating temperature range

4. Are compatible with pump seals and other elements in the system.

5. For aluminum condensing boilers, molybate at 10 to 25 ppm and maintain pH limit below 8.5; refer to boiler manufacturer's recommendation.

6. Chilled Water Loop: The inhibitor shall be a boron-nitrate scale inhibitor compound at 650 to 750 ppm as NO_2 (Nitrite); pH of 9.5 to 10.5; and to maintain Fe (Iron) levels between 0.0 and 0.5 ppm.

7. Heating Water Loop: The inhibitor shall be a boron-nitrate scale inhibitor compound at 750 to 1,000 ppm as NO_2 (Nitrite); pH of 9.5 to 10.5; and to maintain Fe (Iron) levels between 0.0 and 0.5 ppm.

B. Equipment: Provide a bypass feeder with a 5-gallon capacity. The feeder shall be constructed of 10-gauge steel and impervious to the products dispensed. Tank heads shall be a minimum of 9-gauge steel and shall be rated at 300 psi and to 200°F. Chemical feeder shall have inlet and outlet drain valves with full bottom drain. The tank

shall have a wide mouth, 3-1/2” opening so that chemical addition can be performed without the need of a funnel. The bypass feeder shall have a continuous threaded closure requiring 2-1/2 turns to close and seal. Closures rated less than 300 psi shall not be considered equal.

The cap shall be constructed of cast iron with an epoxy-coated underside to prevent corrosion and shall use a square ring gasket seal. The ring gasket shall not be glued or restrained from movement. Closures using “o” rings or gaskets which are glued or restrained from free movement by snap rings shall not be considered equal.

Provide bypass feeder with legs to elevate the feeder off of the floor. The legs shall have holes to allow mounting to anchor bolts.

The bypass feeder shall be provided with a 5-micron filter bag fully supported by a stainless-steel filter basket for simultaneous side stream filtering.

1. Acceptable Manufacturer: Neptune, model FTF-5DB.

C. Test Kit: Provide test kit and reagents for determining proper water conditions.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS PREPARATION:

A. General: After piping systems are erected and proven free of leaks, administer chemicals required for preparation treatment and flushing. Apply chemicals for the time period and in the concentration recommended by the water treatment manufacturer for this portion of the work.

B. Testing: Perform test procedures and submit a written report of test conditions and results to the Engineer. If test results are unsatisfactory, repeat preparation treatment as necessary to achieve test results approved by the Owner's insurance carrier and the Engineer.

3.2 FLUSHING:

A. Drain preparation and boil out products from the systems. Flush with clean water until system tests prove systems are free of preparation and boil out products and other contaminants prior to administering system water treatment as specified hereinbefore.

3.3 CHILLED AND HEATING WATER SYSTEM:

A. Treatment: Treat initial water charge to chilled water loop at 650-750 ppm as NO_2 and heating water loop at 750 to 1000 as NO_2 water systems, after system has been flushed and prepped, to achieve a water quality as specified.

B. Start-up Procedures: During chilled and heating water system start-up, operate chilled and heating water treating systems (after charging with specified chemicals) to maintain the required steady-state characteristics of cooling and heating water. Demonstrate system operation to Owner's operating personnel.

C. Reports: Prepare certified test report for each required water performance characteristic. Comply with the following ASTM standard, where applicable:

1. D 859 - Tests for Silica in Water and Water Waste

2.	D	1067	-	Tests for Acidity or Alkalinity of Water
3.	D	1068	-	Tests for Iron in Water and Wastewater
4.	D	1126	-	Tests for Hardness in Water
5.	D	1128	-	Tests for Identification of Types of Microorganisms and Microscopic Matter in Water and Wastewater
6.	D	3370	-	Sampling Water

D. Water Chemistry: Where water chemistry substantiates that pH is not necessary, chemical fee shall be based on water makeup qualities. Water analysis shall be based on the full parameters of operation, and all possible water supplies. Total hardness and "M" alkalinity of the makeup water will be the determining factor along with the technical limitations of the inhibitors.

3.4 PERSONNEL TRAINING:

A. Operator Training: Train Owner's personnel in use and operation of heating water, chilled water treating systems including preparation of chemical solution reservoir. A Program Administration Manual shall be furnished encompassing all systems in this section of the Specifications.

END OF SECTION 23 25 13

SECTION 23 25 19 – FLUSHING AND CLEANING OF HYDRONIC PIPING SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Common Work Results for HVAC, Section 23 05 00, are included as a part of this Section as though written in full in this document.

1.3 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries.

1.4 DESCRIPTION OF WORK

A. Work Included: Perform water analysis and provide all water cleaning products, holding reservoirs, equipment, and labor for cleaning, and flushing to control water quality for each system.

B. Testing Equipment and Reagents: Furnish suitable water flushing and cleaning equipment for each system, complete with apparatus and reagents necessary.

1.5 QUALITY ASSURANCE

A. Qualifications: The Contractor for work under this Section shall have:

1. A service department and qualified technical service representative located within a reasonable distance of the project site.

1.6 SUBMITTALS

A. Test reports: Submit test reports certified by an officer of the firm on company letterheads, of samples of each treated water system specified. Comply with ASTM D 596 for reporting. Indicate the ASTM best methods for each test.

PART 2 – PRODUCTS

2.1 PROFESSIONAL FLUSHING AND CLEANING SERVICES PERFORMED BY:

A. PurgeRite, a third-party flushing company will be used for flushing and cleaning of the HVAC related piping.

Website:
www.purgerite.com

Email:
sales@purgerite.com

Phone:
936-344-6210.
Address:
13805 N. Highway 75, Suite B
Willis, TX 77378

2.2 GENERAL

A. Pre-Treatment: For new construction and/or renovations to existing hydronic systems, flush and clean all hydronic piping systems to remove and permit flushing of mill scale, oil, grease, and other foreign matter. A school district supervisor is to be present to observe cleaning of hydronic piping systems. Systems shall not be started up until the piping has been cleaned.

2.3 FLUSHING AND CLEANING OF STEEL PIPING SYSTEM:

A. After the mechanical contractor has tested the piping, it is to be flushed and cleaned for service. Provide a complete water flushing and cleaning of the closed loop chilled and hot water systems as specified herein. Systems must be commissioned as clean and meet water treatment specifications.

B. All chilled and hot water piping and related equipment shall be thoroughly flushed out with pre- cleaning chemicals designed to remove deposits such as pipe dope, oils, loose rust, mill scale and other extraneous materials. Recommended dosages of pre-cleaner chemical products shall be furnished by water treatment supplier, added and circulated throughout the water systems. The water system shall then be diluted and final flushed thoroughly until no foreign matter is observed and total alkalinity of the water is equal to or better that that of the make-up water.

C. All temporary connections required for flushing, cleaning, purging, and circulating shall be included. Provide suitable pipe bypasses at each coil and heat exchanger during the flushing and cleaning operation.

D. Self-contained flush unit requirements will contain a pump or pumps connected that will meet or exceed the volume required to flush and purge the system at the required velocity rate through the largest pipe. Pump curve will be submitted along with other important documentation for the related equipment on the unit. This will include, at minimum, filtration, flow meter(s), pressure gauges, and unit description or picture. All operators will comply with all safety regulations of the project site. The flushing operation will be manned continuously during the flushing process.

E. Flushing Procedure Guidelines:

1. Pre-flush: Bypass loops should be installed in front of any strainers and control valves at all equipment components. Coordinate with PurgeRite for proper sizing and placement of bypasses and flush ports.

2. Install temporary strainer elements in front of pumps, tanks, solenoid valves, control valves, and other equipment where permanent strainers are not indicated that are not bypassed. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow-off valve. Strainers should be removed when a self-contained flush unit is used in conjunction with on board filtration.

3. Flush ports should be identified along with the type of high-pressure hose or piping that will be used to connect to the system. The water source should be identified and

must be adequate to fill and make up water in a timely manner to the system during the flush process. A water dump location should be identified which as well is usually the sanitary.

F. Clear Water Flush

1. Fill the piping system with clean potable water. The first flush is a clear- water flush intended to circulate water through the system and force loose debris to low point drains and flush cart filtration system. This flush should be at minimum velocity throughout the system of 5 -7 ft. /sec throughout. Filtration should be at minimum, 50 microns. This flush shall continue until the system water is comparable to the make-up water. Iron content should be under 2.0 ppm.

G. Cleaning & Passivation

1. The second flush cycle is a combined flushing cycle where cleaning and passivation chemicals are introduced into the system to clean the oils and treat the inside wall of the piping system. This process will be monitored by the chemical treatment company to meet the chemical specifications of the water. The cleaning velocity should be between 3 to 5 ft. /sec throughout, and the circulation time will be based on the chemical testing, but will be at minimum, 24 hours.

H. Final Clear Water Flush

1. The system will be continuously flushed while discharging chemicals into the sanitary system as approved locally. As the existing treated water is being discharged, a freshwater make-up source will be utilized to ensure air is not introduced into the system. Continue to drain the system while adding domestic water to dilute the treated water. The chemical treatment company will monitor the outgoing water composition and compare the composition with the incoming water. Flush with fresh water until the conductivity is reduced to that of the make-up water and iron meets specifications. The final system water should be approved by the chemical treatment company. Filtration should be 5 microns.

I. Final Chemical Fill

1. Once the chemical treatment company has determined the system has been brought back to the correct composition, the chemical treatment company will inject the final chemicals into the system. Once the system is filled with the final chemicals it is important the water is not left stagnant.

2. Verify satisfactory completion of clean piping and a final flushing and chemical treatment report should be submitted by field personnel. The report should include at minimum, project name, date, location, parties involved, type of pipes treated, scope summary, flows, durations, and other relevant information.

3. Cleaning chemicals, procedure, water testing, reporting, and consultation must be provided by a qualified water treatment company specializing in this type of work.

2.4 FLUSHING AND CLEANING OF PEX, POLYPROPYLENE, OR HDPE PIPING SYSTEMS:

A. After the mechanical contractor has tested the piping, it is to be flushed and cleaned for service. Provide a complete water flushing and cleaning of the piping as specified herein. Systems must be commissioned as clean.

B. All temporary connections required for flushing, cleaning, purging, and circulating shall be included. Provide suitable pipe bypasses at any equipment or building during the flushing and cleaning operation.

C. Self-contained flush unit requirements should contain a pump or pumps connected that will meet or exceed the volume required to flush and purge the system at the required velocity rate through the largest pipe. Pump curve will be submitted along with other important documentation for the related equipment on the unit. This will include at minimum, filtration, flow meter(s), pressure gauges, and unit description or picture. All operators will comply with all safety regulations of the project site. The flushing operation will be manned continuously during the flushing process.

D. Flushing Procedure Guidelines

1. Pre- Flush:

Bypass loops should be installed at all equipment or building components. Strainers should be removed when a self-contained purge unit is used in conjunction with on board filtration. Flush ports should be identified along with the type of high-pressure hose or piping that will be used to connect to the system. The water source should be identified and must be adequate to fill and make up water in a timely manner to the system during the flush.

2. Clear Water Flush:

Fill the piping system with clean potable water. The first flush is a clear- water flush intended to circulate water through the system and force loose debris to low point drains and flush cart filtration system. This flush should be at minimum velocity throughout the system of 5 – 7 ft. /sec throughout. Filtration should be at minimum, 5 microns. Minimum duration should be calculated using a formula of 1 hour per 1000' of linear pipe and until system water is comparable to make up water source. The minimum circulation time should be 1 hour regardless of the length.

3. Final Chemical Fill

Once the chemical treatment company has determined the system has been brought back to the correct composition, the chemical treatment company will inject the final chemicals into the system if required. Once the system is filled with the final chemicals it is important that the water is not left stagnant and to mix chemicals.

Verify satisfactory completion of clean piping and a final flushing report will be submitted by field personnel. The report will include at minimum, project name, date, location, parties involved, type of pipes treated, scope summary, flows, durations, and other relevant information.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS PREPARATION:

A. General: After piping systems are erected and proven free of leaks, administer chemicals required for preparation treatment and flushing. Apply chemicals for the time period and in the concentration recommended by the water treatment manufacturer for this portion of the work.

B. Testing: Perform test procedures and submit a written final report (at each phase if applicable) of test conditions and results to the Contractor and Consulting Engineer. If

test results are unsatisfactory, repeat preparation treatment as necessary to achieve test results approved by the Owner's insurance carrier and the Engineer.

END OF SECTION 23 25 19

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and Flat Oval ducts and fittings.
3. Double-wall rectangular ducts and fittings.
4. Double-wall round and Flat Oval ducts and fittings.
5. Insulated Flexible Ducts
6. Sheet metal materials.
7. Sealants and gaskets.
8. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

3. Division 23 Section “Duct Insulation” for internal duct liner.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: For each type of the following products:

1. Adhesives.
2. Sealants and gaskets.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Factory- and shop-fabricated ducts and fittings.

3. ¼" = 1'-0" Scale Duct layout drawings indicating sizes, configuration, liner material, static-pressure classes, and bottom of duct elevations. Duct shop drawings shall be superimposed on the architectural backgrounds with the reflected ceiling plans.

4. Dimensions of main duct runs from building grid lines.

5. Fittings.

6. Reinforcement and spacing.

7. Seam and joint construction.

8. Penetrations through fire-rated and other partitions.

9. Equipment installation based on equipment being used on Project.

10. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

11. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

D. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2. Suspended ceiling components.

3. Structural members to which duct will be attached.

4. Size and location of initial access modules for acoustical tile.

5. Penetrations of smoke barriers and fire-rated construction.

6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.

b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports, AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports, and AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Open ends of ductwork shall be factory shrink wrapped air and watertight before shipment to jobsite.

B. Contractor shall adequately protect ductwork from damage after delivery to the project. Ductwork shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver ductwork to the project site until progress of construction has reached the stage where ductwork is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Envirotech Mechanical Systems
2. Gurry Mechanical L.P.
3. Letsos Company
4. Mason Road Sheet Metal Inc.
5. McCorvey Sheet Metal Works
6. Telkin Sheetmetal, Inc.
7. Titan Metals
8. Tomball Sheet Metal Co.
9. MLN
10. Walsh & Albert
11. Grant Sheet Metal
12. Tennapel Sheet Metal
13. McGill AirFlow LLC.
14. Texas Duct Systems
15. South Texas Sheet Metal
16. Texas Air Duct Systems
17. SEMCO Incorporated
18. Lindab Inc.

B. Fabricate ducts with indicated dimensions for the inner duct.

C. Sheet Metal Connectors, Inc

D. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

E. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FLAT OVAL DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Envirotech Mechanical Systems
2. Gurry Mechanical L.P.
3. Letsos Company
4. Mason Road Sheet Metal Inc.
5. McCorvey Sheet Metal Works
6. Telkin Sheetmetal, Inc.

7. Titan Metals
8. Tomball Sheet Metal Co.
9. MLN
10. Walsh & Albert
11. Grant Sheet Metal
12. Tennapel Sheet Metal
13. McGill AirFlow LLC.
14. Texas Duct Systems
15. South Texas Sheet Metal
16. Texas Air Duct Systems
17. SEMCO Incorporated
18. Lindab Inc.

B. Fabricate ducts with indicated dimensions for the inner duct.

C. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

D. Triple-Rib shall be acceptable for single wall spiral lockseam ducts: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

E. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

G. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Envirotech Mechanical Systems
2. Gurry Mechanical L.P.
3. Letsos Company
4. Mason Road Sheet Metal Inc.
5. McCorvey Sheet Metal Works
6. Telkin Sheetmetal, Inc.
7. Titan Metals
8. Tomball Sheet Metal Co.
9. MLN
10. Walsh & Albert
11. Grant Sheet Metal
12. Tennapel Sheet Metal
13. McGill AirFlow LLC.
14. Texas Duct Systems
15. South Texas Sheet Metal
16. Texas Air Duct Systems
17. SEMCO Incorporated
18. Lindab Inc.

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: K = 0.23 at 75 deg. F mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

3. Coat insulation with antimicrobial coating.

4. Cover insulation with polyester film complying with UL 181, Class 1.

G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: K = 0.23 at 75 deg. F mean temperature.

H. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

I. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

J. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Envirotech Mechanical Systems
2. Gurry Mechanical L.P.
3. Letsos Company
4. Mason Road Sheet Metal Inc.
5. McCorvey Sheet Metal Works
6. Telkin Sheetmetal, Inc.
7. Titan Metals
8. Tomball Sheet Metal Co.
9. MLN
10. Walsh & Albert
11. Grant Sheet Metal
12. Tennapel Sheet Metal
13. McGill AirFlow LLC.
14. Texas Duct Systems
15. South Texas Sheet Metal
16. Texas Air Duct Systems
17. SEMCO Incorporated
18. Lindab Inc.

B. Fabricate ducts with indicated dimensions for the inner duct.

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

D. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

   a. Transverse Joints in Ducts Larger Than 60 Inches Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved,

duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: K = 0.23 at 75 deg F mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

3. Coat insulation with antimicrobial coating.

4. Cover insulation with polyester film complying with UL 181, Class 1.

G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: K = 0.23 at 75 deg F mean temperature.

2.5 DOUBLE-WALL FLAT OVAL / ROUND / RECTANGULAR OUTDOOR DUCTWORK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Envirotech Mechanical Systems
2. Gurry Mechanical L.P.
3. Letsos Company
4. Mason Road Sheet Metal Inc.
5. McCorvey Sheet Metal Works
6. Telkin Sheetmetal, Inc.
7. Titan Metals
8. Tomball Sheet Metal Co.
9. MLN
10. Walsh & Albert
11. Grant Sheet Metal
12. Tennapel Sheet Metal
13. McGill AirFlow LLC.
14. Texas Duct Systems
15. South Texas Sheet Metal
16. Texas Air Duct Systems

17. SEMCO Incorporated
18. Lindab Inc.
19. Linx.

B. Fabricate ducts with indicated dimensions for the inner duct.

C. Material:

1. Outer Duct: 18-gauge epoxy coated galvanized duct.

2. Material thickness constructed in accordance with latest SMACNA's HVAC Duct Construction Standards.

D. Inner Duct: 20 gauge perforated galvanized duct.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B.

1. Minimum 2" insulation and R-value of 8 at 75°F mean ambient temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.

3. Coat insulation with antimicrobial coating.

F. Exterior Coating / Finish.

1. Epoxy coated exterior duct.

2. Average thickness of 4 mils to meet or exceed 3,000-hour salt spray test per ASTM B17-97.

3. Coordinate color with the architect and the owner.

2.6 INSULATED FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thermaflex Type M-KE.
b. Atco

B. Product Description: UL 181, Class 1, CPE fabric attached to helical wound spring galvanized steel wire; fiberglass insulation; aluminized vapor barrier film.

a. Pressure Rating: six (6) inches wg positive and four (4) inches wg negative.
b. Maximum Velocity: 4,000 fpm.
c. Temperature Range: -20 degrees Fahrenheit to 210 degrees Fahrenheit.
d. Thermal Resistance: Minimum R-6 installed.
e. Maximum flexible duct length shall not exceed 5'-0".

C. Provide Flexible Duct Elbow Supports at each diffuser. Refer to "23 33 00 Air Duct Accessories"; 2.10 Flexible Duct Elbow Supports.

2.7 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Duct straps shall be wrapped from the top cord of joists; straps wrapped from the bottom chord will not be accepted.

E. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

F. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

G. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Ductwork installed on the roof shall be installed and supported such that the roof may be maintained / repaired without the need to disassemble any ductwork.

3.2 REQUIREMENTS FOR DRYER EXHAUST DUCTS

A. Dryer exhaust ducts for clothes dryers shall be smooth, rigid galvanized duct and shall terminate on the outside of the building and shall be equipped with a backdraft damper. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust flow. Clothes dryer exhaust ducts shall not be connected to a vent connector, vent, or chimney. Clothes dryer exhaust ducts shall not extend into or through ducts or plenums. Provide weather resistant stainless-steel wall cap at duct / wall penetration and a minimum 8” relief hood at roof penetration with roof curb, flashing and counter flashing.

3.3 REQUIREMENTS OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.4 ADDITIONAL REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.5 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. For fastening of sheet metal support straps on each side of the duct, provide (2) two sheet metal screws on the side of the duct and (1) one on the bottom of the duct for a total of (6) six sheet metal screws for maximum fastening of strap to sheet metal duct.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint all outdoor ductwork, exposed ductwork and exterior of metal ducts that are visible through cloud ceilings, registers, and grilles, etc. and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer; refer to paint manufacturer’s instructions to prevent peeling. Coordinate final paint color with architect. Paint materials and application requirements are specified in Division 09 painting Sections.

3.9 DUCT STORAGE / CLEANING

A. Ductwork shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4” above the floor and shall be completely covered in plastic with no exposed ends. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not “dried-in”. If this is required, the entire lengths of duct shall be covered in plastic for protections. The Owner / Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing NADCA certified Contractor.

B. The working area shall be clean, dry and the ductwork protected from dust. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.

3.10 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. All exposed ducts in spaces such as but not limited to: Gymnasiums, Natatoriums, Cafeteria’s, Libraries, etc.: Double wall insulated round ductwork.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Split-DX System Air Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive 1-inch wg.
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round: 12.

2. Ducts Connected to Constant-Volume Air-Handling and Rooftop Units:

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round: 6.

3. Ducts Connected to Variable-Air-Volume Air-Handling and Rooftop Units:

    a. Pressure Class: Positive 4-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round: 3.

C. Return and Outside Air Ducts:

1. Ducts Connected to Fan Coil Units, Split-DX System Air Units Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 1-inch wg.
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round: 12.

2. Ducts Connected to Air-Handling and Rooftop Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round: 6.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

    a. Pressure Class: Negative 1-inch wg.
    b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round: 6.

2. Ducts Connected to Air-Handling and Rooftop Units:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round: 6.

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

    a. Exposed to View: 18-gauge Type 304, stainless-steel sheet, No. 4 finish.
    b. Concealed: 16-gauge Carbon-steel sheet.
    c. Continuously welded seams and joints
    d. Pressure Class: Positive or negative 2-inch wg.
    e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
    f. SMACNA Leakage Class: 3.

4. Ducts Connected to Dishwasher Hoods:

    a. 18-gauge Type 304, stainless-steel sheet.
    b. Exposed to View: No. 4 finish.
    c. Concealed: No. 2D finish.
    d. Continuously welded seams and joints
    e. Pressure Class: Positive or negative 2-inch wg.
    f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
    g. SMACNA Leakage Class: 3.

5. Ducts Connected to Shower Return air grilles:

    a. 18-gauge Type 304, stainless-steel sheet.
    b. Exposed to View: No. 4 finish.
    c. Concealed: No. 2D finish.
    d. Continuously welded seams and joints
    e. Pressure Class: Positive or negative 2-inch wg.
    f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
    g. SMACNA Leakage Class: 3.

6. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

    a. Type 316, stainless-steel sheet.

        1. Exposed to View: No. 4 finish.
        2. Concealed: No. 2D finish.

    b. Continuously welded seams and joints
    c. Pressure Class: Positive or negative 3-inch wg.
    d. Minimum SMACNA Seal Class: A.
    e. SMACNA Leakage Class: 3.

7. Ducts Connected to Chlorine and Acid Rooms (ASHRAE 62.1, Class 3 and 4) Air:

    a. Type 316, stainless-steel sheet.

        1. Exposed to View: No. 4 finish.
        2. Concealed: No. 2D finish.

    b. Continuously welded seams and joints
    c. Pressure Class: Positive or negative 3-inch wg.
    d. Minimum SMACNA Seal Class: A.
    e. SMACNA Leakage Class: 3.

8. Ducts Connected to Fans Exhausting Welding Fumes (ASHRAE 62.1, Class 3 and 4) Air:

a. Type 316, stainless-steel sheet.

1. Exposed to View: No. 4 finish.
2. Concealed: No. 2D finish.

b. Continuously welded seams and joints
c. Pressure Class: Positive or negative 3-inch wg.
d. Minimum SMACNA Seal Class: A.
e. SMACNA Leakage Class: 3.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1. Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or welded.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1,000 fpm or Lower: 90-degree tap.
    b. Velocity 1,000 to 1,500 fpm: Conical tap.
    c. Velocity 1,500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 31 18- FABRIC DUCT

PART 1-GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. DESCRIPTION OF WORK

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.

B. Types of non-metal ductwork required for this project include the following:

1. Fabric Air Dispersion Products suitable for Natatoriums and Gymnasiums.

1.3. QUALITY ASSURANCE

A. Building Codes and Standards:

1. Product must be Classified by Underwriters Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and are also classified in accordance with ICC Evaluation Service AC167.

2. All product sections must be labeled with the logo and classification marking of Underwriters Laboratories.

B. Design & Quality Control

1. Manufacturer must have documented design support information including duct sizing, vent and orifice location, vent and orifice sizing, length, and suspension. Parameters for design, including maximum air temperature, velocity, pressure and fabric permeability, shall be considered and documented.

1.4. SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: Submit manufacturer’s specifications on materials and manufactured products used for work of this section.

C. Building Code Data: Submit UL file number under which product is Classified by Underwriters Laboratories.

D. Provide detailed drawings confirming configuration of Fabric Tensioning System (components, support locations, segment lengths) and Textile Dispersion System (diameter, lengths, airflow, pressure, velocity, and textile permeability).

E. Provide detailed installation instructions for components to be installed.

1.5. WARRANTY

A. Manufacturer must provide a complete product (20) twenty-year pro-rated warranty for products supplied for the fabric and suspension of this system as well as a Design and

Performance Warranty. Laundering frequency nor any other conditions shall pertain to warranty terms.

1. Years (1) one through (10) ten: 100% coverage.

2. Years (11) eleven through (15) fifteen: 50% coverage.
.

3. Years (16) sixteen through (20) twenty: 25% coverage.

1.6. DELIVERY, STORAGE AND HANDLING

A. Protect fabric air dispersion systems from damage during shipping, storage, and handling.

B. Contractor shall adequately protect ductwork from damage after delivery to the project. Ductwork shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver ductwork to the project site until progress of construction has reached the stage where ductwork is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products manufactured in the United States by the following:

1. DuctSox – Sedona Xm

2. FabricAir, Inc. - Combi 80

2.2 FABRIC AIR DISPERSION SYSTEM

A. Air diffusers constructed with internal tensioning frame.

1. System shall cylindrically tension fabric along the entire length of fabric duct, including all fittings (crosses, elbows, reducers, and tees).

2. Tensioning system shall include full 360-degree tensioning and intermediate rings with quick connection spacer tubes concealed inside the fabric system.

3. Interior structure to include multiple mechanically adjustable tension devices. To provide proper fabric tensioning, structural and fabric system shall be configured in segments of no more than 45 feet.

4. Fabric components supported solely by metal cylindrical rings.

5. Each cylindrical ring shall require vertical metal to metal vertical cable safety attachment.

6. If within a natatorium, all metal structural components shall be able to withstand chlorinated environment and shall not be susceptible to corrosion. Provide necessary coatings and materials.

B. Air diffusers constructed with external structural frame.

1. The system shall be made with sewn in but removable aluminum hoops. The hoops shall:

   a. Maintain the ducts' cylindrical shape at all times.

   b. Be made to a circular arc angle of 180° (8" - 48"), 120° (49" - 60"), 90° (61" - 68") or 60° (69" - 80") depending on duct diameter.

   c. Shall be centered at the 12:00 o'clock position of the duct.

   d. Shall be installed at the factory, on-site installation shall not be allowed.

2. Diameter and spacing of hoops shall be determined by the manufacturer based on duct diameter.

3. Elbows of 70° or more shall have at least two hoops.

4. Air dispersion shall be accomplished with linear or polar arrays of laser cut orifices. Size of laser cut orifices shall be from 1" to 5" diameter. Due to exact throw requirements and NC requirements alternative flow models are not acceptable.

5. Number of orifices shall be determined by manufacturer.

6. Fabric system shall include connectors to attach to suspension system.

7. If within a natatorium, all metal structural components shall be able to withstand chlorinated environment and shall not be susceptible to corrosion. Provide necessary coatings and materials.

C. FABRIC

1. Fabric Color: Provide sample swatch of actual material and color with submittal and coordinate with the architect.

2. Fabric air dispersion system shall be constructed of a woven, 100% anti-microbial treated, fire retardant and permeable fabric complying with the following characteristics:

   a. Filament/filament twill polyester that includes 55% recycled content, treated with a machine washable anti-microbial agent by the fabric manufacturer, fire retardant in accordance with UL 2518. Non-linting filament yarn to meet the requirements of ISO Class 3 environment.

   b. Duct Shape: ROUND (coordinate with plans).

c. Fabric: 100% Flame Retardant Polyester, factory treated with an EPA approved antimicrobial agent

d. Base Permeability @ 0.5" WG: 2 CFM / ft² per ASTM D737; shall be verified by the Frazier Permeability Test.

e. Weight: 8.5 oz. / yd² per ASTM D3776.

f. Shrinkage: Max. 0.5% per DIN EN 26 630.

g. Temperature Range: -40°F and +284°F.

h. Fire Retardancy: Shall meet the requirements in NFPA 90-A, ICC AC167 and UL 2518.

D. TEXTILE SYSTEMS FABRICATION REQUIREMENTS

1. Provide system in modular lengths optimized for maintenance, connected by zippers with proper radial securing clips (inlets, endcaps, and mid-sections) and top access zippers (if required) for vertical cable safety attachment. Zippers shall provide closure completely around the circumference to prevent leakage. Required number of zippers shall be specified by the manufacturer.

2. Integrated air dispersion outlets (orifices, nozzles, linear vents or other) shall be specified and approved by manufacturer.

3. The system shall be made of permeable fabric. Base permeability of fabric shall be reached based on a combination of weave construction and a thermo fixation process in order to prevent permeability degradation after wash. Fabric permeability based on a calendaring process is not acceptable.

4. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener – supplied by contractor.

5. Inlet connection includes zipper for easy removal / maintenance.

6. Lengths to include required intermediate zippers as specified by manufacturer.

7. End cap includes zipper for easy maintenance.

8. Each section of the fabric shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information

E. DESIGN PARAMETERS

1. Fabric air diffusers shall be designed from 0.25” water gage minimum to 3” maximum, with 0.5” as the standard.

2. Fabric air diffusers shall be limited to design temperatures between -40°F and +284°F.

3. Design CFM, diameter, dispersion, static pressure, and diffuser length shall be designed or approved by the manufacturer.

4. Do not use fabric diffusers in concealed locations.

5. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.

PART 3 – INSTALLATION

3.1 INSTALLATION OF FABRIC AIR DISPERSION SYSTEM

A. Install chosen suspension system with minor noise and fabric motion at start-up in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product. Suspension Track and cable within a natatorium shall be able to withstand chlorinated environment and shall not be susceptible to corrosion. Provide necessary coatings and materials.

3.2 CLEANING AND PROTECTION

A. Clean air handling unit and ductwork prior to the fabric air dispersion system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If fabric dispersion system becomes soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION 23 31 18

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Back-draft dampers.
2. Combination fire-and-smoke dampers.
3. Duct access doors.
4. Fire dampers.
5. Smoke dampers.
6. Volume control dampers.
7. Flexible duct connections
8. Duct Taps
9. Duct test holes
10. Flexible duct elbow supports

B. Related Sections:

1. Section 23 31 00 - HVAC Duct and Casings: Requirements for duct construction and pressure classifications.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.

C. Product Data: Submit data for shop fabricated assemblies including fire dampers including locations and ratings, smoke dampers including locations and ratings, backdraft dampers, flexible duct connections, volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit for Fire, Smoke and Combination Fire/Smoke Dampers.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

1.6 COORDINATION

A. Coordinate Work where appropriate with building control Work.

B. Coordinate fire alarm wiring requirements with Division 26.

1.7 WARRANTY

A. Furnish five (5) year manufacturer warranty for duct accessories.

1.8 EXTRA MATERIALS

A. Furnish two (2) of each size and type of fusible link for fire rated dampers.

PART 2 - PRODUCTS

2.1 BACK-DRAFT DAMPERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Arrow United Industries
2. American Warming and Ventilating
3. Ruskin
4. Air Balance
5. NCA
6. Pottorff
7. Greenheck

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel, or extruded aluminum. Blades, maximum 6-inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Cesco
2. NCA
3. Ruskin
4. Nailor
5. Pottorff
6. Greenheck

B. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S. Dampers shall be Leakage Class 1. Damper shall include a factory installed sleeve.

C. Construction: Fabricate with 16 gage roll formed, galvanized steel hat-shaped channel frame. Furnish stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, concealed linkage, and 1/2-inch actuator shaft. Blades shall be airfoil type, 14-gauge equivalent. Blade edge seals shall be mechanically fastened to blade.

D. Operators: UL listed and labeled two-position, fail close, electric type suitable for 120 volts, single phase, 60 Hz. Furnish end switches to indicate damper position. Locate damper operator on exterior of sleeve and link to damper operating shaft.

E. Temperature rating: 250°F.

F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of Electro thermal link, flexible stainless-steel blade edge seals to produce constant sealing pressure.

G. Coordinate fire alarm control wiring with Division 26.

H. Rating: 1-1/2 hours in wall rated at less than three (3) hours.

I. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of Electro thermal link, flexible stainless-steel blade edge seals to produce constant sealing pressure, stainless steel springs with locking devices to maintain positive closure for units mounted horizontally.

J. Electric Fuse Link: Heat actuated, quick detecting to release at 165 degrees Fahrenheit, UL listed and labeled. Controlled closing and locking of damper in 7-15 seconds to allow duct pressure to equalize. Instantaneous closure is not acceptable. Manual reset at damper.

2.3 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1-inch-thick insulation with sheet metal cover.

1. Less Than 12 inches square, secure with sash locks.

2. Up to 18 inches Square: Furnish two hinges and two (2) sash locks.

3. Up to 24 x 48 inches: Three hinges and two compression latches with outside handles.

4. Larger Sizes: Furnish additional hinge.

5. Access panels with sheet metal screw fasteners are not acceptable.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Cesco
2. NCA
3. Ruskin
4. Nailor
5. Pottorff
6. Greenheck

B. Fabricate in accordance with NFPA 90A and UL 555, and manufacturer's condition of listing. Permanently mark dampers for use in dynamic systems.

C. Ceiling Fire Dampers: Galvanized steel, 24 gage frame and 24 gage blades with UL classified insulation if required. Provide with radiation blanket.

D. Curtain Type Dampers: 20 gage Galvanized steel frame with interlocking 24 gage galvanized steel blades. Furnish stainless steel closure springs and latches for horizontal installations and closure under airflow conditions. Configure with blades out of air stream.

E. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless-steel sleeve bearings and plated steel axles, 1/8 x 1/2-inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 165 degrees Fahrenheit.

G. Rating: 1-1/2 hours in wall rated at less than three (3) hours.

2.5 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Cesco
2. NCA
3. Ruskin
4. Nailor
5. Pottorff
6. Greenheck

B. Fabricate in accordance with UL 555S, Leakage Class I.

C. Construction: Fabricate with 16 gage roll formed, galvanized steel hat-shaped channel frame. Furnish self-lubricating stainless-steel sleeve bearings and plated steel axles, stainless steel jamb seals, concealed linkage and 1/2-inch actuator shaft. Blades shall be airfoil type, 14-gauge equivalent. Blade edge seals shall be mechanically fastened to blade.

D. Operators: UL listed and labeled two-position, fail close, electric type suitable for 120 volts, single phase, 60 Hz. Furnish end switches to indicate damper position. Actuator to be mounted internally or externally as required.

E. Temperature rating: 250°F.

F. Coordinate fire alarm control wiring with Division 26.

2.6 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Splitter Dampers:

1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.

2. Blade: Fabricate of single thickness sheet metal secured with continuous hinge or rod with end bearings.

3. Operator: Minimum 1/4-inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

C. Single Blade Dampers: Fabricate for duct height up to 12”.

D. Multi-Blade Damper: Opposed blade interlocking type pattern for duct height 12” and greater. Assemble blades in galvanized frame channel with suitable hardware and linkage concealed in frame. Provide multiple section dampers for sizes larger than 48-inch x 72 inch. Provide jack shafting configuration and crossovers.

E. Damper Blades:

1. Provide 16-gauge galvanized steel center and edge grooved blade type where velocities do not exceed 1500 FPM.

2. Provide 14 gage galvanized steel. Roll formed airfoil blade type where velocities exceed 1500 FPM.

3. Maximum leakage shall be 8 CFM per square foot of damper area at four (4) inches wg pressure.

F. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or bronze bearings. Furnish closed end bearings on ducts having pressure classification over two (2) inches wg.

G. Quadrants:

1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers that do not have actuators.

2. On insulated ducts mount quadrant regulators on 2” standoff mounting brackets, bases, or adapters.

3. Where rod lengths exceed 30 inches furnish regulator at both ends.

4. Provide remote damper operators for concealed dampers. Operator shall utilize miter gears, worm gears and couplings or be cable operated. Coordinate operator trim and location with Architect / Engineer.

H. Actuators:

1. Maximum damper area per actuator shall be 24 square feet face area.

2. Actuators shall be two position or modulating spring return type.

3. Duct mounted dampers shall have actuators mounted outside of air stream.

4. Coordinate with Section 23 09 23 – Direct-Digital Control System for HVAC.

2.7 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Connector: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.

2. Net Fabric Width: Approximately six (6) inches wide.

3. Metal: Three (3) inch wide, galvanized steel. Same gage as connecting duct.

4. Install flexible connections with a minimum of one (1) inch between metal edges.

5. Provide flexible duct connections at every duct connection to equipment.

C. Application:

1. Flexible duct connectors are not permitted on duct connections to internally isolated equipment. Internal isolation shall be in accordance with Section 230548.

2.8 DUCT TAPS

A. Provide 24-gauge galvanized steel conical fittings with integral balancing damper for duct taps serving single ceiling diffuser. Balancing damper shall consist of 24 gauge, 3/8” steel axel and nylon end bearings with 2” standoff quadrant mount.

B. Provide 24-gauge galvanized steel 45 degree, rectangular to round, side takeoff fitting with integral balancing damper when airflow is less than or equal to 20 percent of main duct airflow. Balancing damper shall consist of 24 gauge, 3/8” steel axel and nylon end bearings with 2” standoff quadrant mount.

C. Provide tee split with radius elbow when takeoff or branch duct airflow is greater than 20 percent of main duct. Square throat elbows are acceptable in areas of limited clearances. Provide splitter damper. Refer to Section 23 31 00 - HVAC Duct and Casings.

D. Provide volume damper at all takeoffs in constant volume systems and at all takeoffs downstream of terminal units in variable volume systems.

2.9 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, airtight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

B. Coordinate test hole locations and requirements with TAB contractor. If additional test holes are required for TAB, contractor will provide at no additional cost.

2.10 FLEXIBLE DUCT ELBOW SUPPORTS

A. Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6" – 16". Elbow supports shall be UL listed for use in return air plenum spaces.

B. Provide elbow supports at each diffuser connection.

C. Manufactured by Thermaflex – FlexFlow Elbow

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Verify ducts and equipment is ready for accessories.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 REPORTS

A. Per NFPA 90A, all fire dampers, smoke dampers and fire/smoke dampers must be tested prior to occupancy and contractor shall provide written confirmation if the dampers are operating as required. Provide pass / fail report in excel spreadsheet. Include type of damper, damper manufacturer / model, actuator manufacturer / model, fusible link in the excel spreadsheet.

B. Contractor to provide as-built drawings of location of all fire, smoke and fire/smoke dampers with appropriate label that matches the installation.

C. Per NFPA 80, contractor shall test and inspect all dampers prior to one (1) year warranty period. All inspections, testing and maintenance of dampers must be documented, indicating the location of the damper, date(s) of inspection, name of inspector and deficiencies discovered. The document must have a space to indicate when and how the deficiencies were corrected. All documentation is expected to be maintained and made available for review by the AHJ.

D. After first year, test and inspection frequency must be every 4 years.

3.3 INSTALLATION.

A. Install in accordance with NFPA 90A and follow SMACNA HVAC Duct Construction Standards Metal and Flexible. Refer to Section 23 31 00 - HVAC Duct and Casings for duct construction and pressure class.

B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside if motorized dampers are not shown on plans.

C. Install duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and as indicated on Drawings. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Install minimum 8 x 8-inch size for hand access, 18 x 18-inch size for shoulder access, and as indicated on Drawings. Review locations prior to fabrication.

D. Install temporary duct test holes required for testing and balancing purposes. Cut or drill in ducts. Cap with neoprene plugs, threaded plugs, threaded or twist-on metal caps.

E. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, and breakaway duct connections.

F. Install smoke dampers and combination fire and smoke dampers in accordance with NFPA 92A.

G. Install volume dampers at points on supply, return, outside air and exhaust systems where branches extend from larger ducts. For air systems with common return air plenum provide volume dampers in both outside air and return air ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.
3. Install stainless steel volume dampers in stainless steel ducts.
4. Install aluminum volume dampers in natatoriums.

3.4 DEMONSTRATION

A. Demonstrate re-setting of fire dampers, fire and smoke dampers and smoke dampers to Owner's representative.

END OF SECTION 23 33 00

SECTION 23 33 19 - DUCT SILENCERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Duct silencers.
2. Crosstalk silencers.
3. Ductwork lagging.

1.3 PERFORMANCE REQUIREMENTS

A. Sound control components are selected to maintain the sound level of space at levels not to exceed those listed below. The midpoint of Noise Criteria (NC) curves shall apply.

B. Sound control components are designed to maintain rooms at the following maximum sound levels, in Noise Criteria (NC) as defined by HVAC Applications and ANSI S1.8.

1. **Offices**

a. Executive: 30
b. Conference rooms: 30
c. Private: 35
d. Open-plan areas: 35
e. Computer/business machine areas: 40
f. Public circulation: 40

2. **Schools**

a. Lecture and classrooms: 30
b. Open-plan classrooms: 35

3. **Libraries:** 25

4. **Theaters**

a. Theater: 25
b. Stage house: 25
c. Trap room: 25
d. Orchestra pit: 25
e. Rehearsal rooms: 25
f. Teaching studios: 30
g. Practice rooms: 30
h. Ensemble rooms: 30
i. Shop: 45

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.

C. Product Data: Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

D. Design Data: Submit selection of each individual trap. Selection shall indicate airflow and pressure drop. Sound attenuators shall be selected based on full return airflow.

E. Test Reports: Indicate acoustic housings meet or exceed specified sound transmission loss values.

F. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

G. Manufacturer's Certificate: Certify silencers meet or exceed specified requirements.

H. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of crosstalk silencers, acoustic housings, duct silencers and ductwork lagging. Record actual locations of hangers including attachment points.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AMCA 300, ANSI S1.13, ARI 575, ANSI S12.36, standards and recommendations of ASHRAE 68.

B. Combustion ratings for the silencer acoustic fill material shall not be greater than the following when tested to ASTM E84, NFPA Standard 255 or UL No. 723:

1. Flame Spread Classification: 20
2. Smoke Development Rating: 20
3. Fuel Contribution: 20

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) year’s experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

B. Do not deliver Equipment to the project site until progress of construction has reached the stage where sound attenuators are actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 DUCT SILENCERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Aerosonics
2. United McGill
3. IAC
4. Vibro-Acoustics
5. Dynasonics
6. Commercial Acoustics
7. Ruskin
8. Price

B. Description: Sheet metal outer casing, sound absorbing fill material with coating, and inner casing of perforated sheet metal with integral interior baffles of similar construction. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Configuration:

1. Tubular with inner casing and liner, aerodynamically shaped center body with nose cone and truncated tail cone, diameter and length as indicated on Drawings.

2. Rectangular with lined splitters with radius nose and contoured tails. Size as indicated on Plans.

D. Materials:

1. Outer Casing: Minimum 22 gage thick galvanized steel stiffened with mastic filled lock formed seams, two (2) inch long, 11 gage button punched slip joints on both ends.

2. Inner Casing and Splitters: Minimum 24 gage thick perforated galvanized steel.

3. Fill: Glass fiber or mineral wool of minimum 3 lb/cu ft density with antimicrobial and erosion coatings.

E. Rating:

1. ASTM E477 Insertion Loss and Maximum Generated Noise based on 1000 fpm Face Velocity. Performance criteria listed below based on IAC model LFM:

Insertion Loss (dB)

Length - Octave Band Center Frequency (Hz)

		63	125	250	500	1000	2000	4000
Forward Flow	3 FT	4	7	13	16	15	10	9
	5 FT	6	10	17	25	25	14	11
Reverse Flow	3 FT	5	7	13	17	16	11	10
	5FT	7	12	19	27	27	14	13

Generated Noise (dB)

	Octave Band Center Frequency (Hz) 63	125	250	500	1000	2000	4000
Forward Flow (all lengths)	32	24	32	25	34	39	24
Reverse Flow (all lengths)	31	30	34	35	40	45	28

2. Maximum static pressure shall not exceed 0.17 inches wg.

3. Return air silencers installed at mechanical room walls shall be sized for full design return flow to mechanical room. Outside air and exhaust air shall not be subtracted from return in order to ensure silencers operate within design parameters for all modes of operation.

2.2 CROSS-TALK SILENCERS / TRANSFER DUCT

A. Description: Double wall sheet metal duct elbow with 1” insulation and perforated liner covering entire inside surface. Size as indicated on plans. Refer to Section 23 31 13 and detail on Plans.

B. Casing: Construct elbow using duct gauges specified for size shown.

C. Rating:

1. Size transfer duct at a maximum of 500 fpm Face Velocity.
2. Full design return air flow form space shall be used for sizing transfer ducts.
3. Maximum static pressure loss through transfer duct shall not exceed 0.05 inches wg.

2.3 DUCTWORK LAGGING

A. Acoustic Insulation: Two (2) inch thick, 3 to 5 lb/cu ft density glass fiber or mineral wool insulation.

B. Covering: Gypsum board with surface weight minimum 4 lb/sq ft. All joints of covering shall be sealed as specified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Support duct silencers independent of ductwork.

B. Install crosstalk silencers in wall. Pack and resiliently seal wall penetration.

C. Lag ductwork at wall by wrapping with insulation and covering. Lagging of duct will be identified on the plans. Apply covering to be airtight. Do not attach covering rigidly to ductwork. Fire damper sleeve shall be lagged at wall penetration, no exception.

D. Silencers shall be installed in accordance with manufacturer recommendations.

E. Silencers installed in duct systems that generate excessive system effect and pressure drop shall be removed and installed correctly by contractor at no additional cost.

F. Duct transition upstream of silencers shall be 30 degrees maximum. Duct transition downstream of silencer shall be 15 degrees maximum.

G. Silencers shall be installed a distance of (3x duct diameter) from elbows.

H. Silencers shall be installed a minimum of (1x duct diameter) from fan or unit outlets / inlets.

I. Where multiple silencers are ganged together provide continuous galvanized steel nosing, crimped or button punched, on internal partitions.

J. Silencers at mechanical room walls shall be installed with wall at midway point of casing. Pack and resiliently seal wall penetration. Silencers may be placed with overhang on either side of wall to allow coordination with trades.

K. Silencers located at fire rated walls shall be connected to wall sleeve of damper. Provide duct lagging on damper sleeve.

END OF SECTION 23 33 19

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide complete, fully operational fans where indicated on Drawings.

B. Section Includes:

1. Hooded propeller roof fans
2. Upblast centrifugal roof fans
3. Upblast centrifugal roof fans – Grease exhaust
4. Centrifugal filtered supply fans
5. Inline Fans

C. Related Sections:

1. Section 23 31 00 - HVAC Duct and Casings - Ducts: Product requirements for hangers for placement by this section.

2. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

3. Coordinate work in this Section with Division 7.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, and ductwork and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturer’s instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705 and UL 762 for kitchen exhaust.

D. Balance Quality: Conform to AMCA 204.

1.6 WARRANTY

A. Furnish one (1) year manufacturer's warranty for fans. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start up will not be acceptable.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Spare materials shall be provided by equipment manufacturer and not by the installing mechanical contractor.

1. Fan Belts: Two (2) sets for each belt-driven fan.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Fans shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver Equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

1.9 UNIT IDENTIFACTION REQUIREMENTS

A. Furnish each fan with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:

- Unit identification as indicated within Contract Documents.
- Serial Number.
- Model Number.
- Capacity (CFM) and static pressure (w.g.).
- Motor Horsepower.
- Fan RPM.
- Unit Power Supply: Volts / PH / Amps.
- Supply Fan Drive Type.
- Sales Order #.
- Date of unit manufactured.

PART 2 - PRODUCTS

2.1 HOODED PROPELLER ROOF FANS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck.
2. Cook.
3. Acme.

B. Unit shall be a low profile, hooded, roof mounted, belt driven or direct drive, propeller supply ventilator. Coordinate drive with fan schedule on drawings.

C. Fan shall be constructed in accordance with UL 705. Fan shall bear the AMCA certified ratings seal for air performance.

D. Construction: The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The motor, bearings and drives shall be mounted on a welded tubular steel power assembly. The power assembly shall be rigidly secured to the fan housing. The powder coated steel fan housing shall include a minimum 14-gauge base with integral spun venturi and continuously welded or application of butyl tape to inside of the curb cap for maximum leak protection. The fan shall be enclosed with a minimum 18-gauge galvanized steel hood bolted to the fan housing. The hood shall have a removable top cap to allow unobstructed access to the motor and power assembly without removing entire hood. The fan outlet shall be protected from entry of foreign material by ½" x ½" galvanized steel screen. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

E. Coating: All ungalvanized steel fan components shall be treated with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000-hour salt spray under ASTM B117 test method.

F. Propeller: Propeller shall be a high-efficiency fabricated steel design with blades securely fastened to a minimum 7-gauge steel hub. The hub shall be keyed and locked to the fan shaft utilizing two setscrews. Propeller shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

G. Motor: Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase, and enclosure.

H. Bearings: Bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing

selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

I. Drives: Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

J. Roof Curb:12-inch-high of 18-gauge galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2-inch insulation, damper tray, hinged curb adapter for access to dampers, and factory installed nailer strip. Coordinate installation with Division 7.

K. Accessories:

1. Motorized damper in damper tray of roof curb. Actuator shall be same voltage as motor in fan. Damper shall energize fan through integral end switch.

2. Disconnect Switch: Coordinate with Division 26. Provide factory wired disconnect switch on 120v motor only. Factory provided disconnect switches shall be rated for outdoor use. Three phase combination disconnect/starter shall be provided by Division 26.

3. Direct drive units shall be provided with motor speed control option.

2.2 UPBLAST CENTRIFUGAL ROOF FANS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck.
2. Cook.
3. Acme.

B. Fan shall be a spun aluminum, roof mounted, belt driven or direct drive, upblast centrifugal ventilator. Coordinate drive with fan schedule on drawings.

C. Fan shall be constructed in accordance with UL 705. Fan shall bear the AMCA certified ratings seal for air performance.

D. Construction: The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16-gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have sealed curb cap corners by continuous weld or application of butyl tape to inside of the curb cap for maximum leak protection. The windband shall have a rolled bead for added strength. A two-piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. An integral conduit chase shall be provided into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 14-gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Lifting lugs shall be provided to help prevent damage from improper lifting. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

E. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap

an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

F. Motor: Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase, and enclosure.

G. Bearings: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

H. Drives: Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150 percent of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

I. Roof Curb: 12-inch-high of 18-gauge galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2-inch insulation, damper tray, hinged curb adapter for access to dampers, and factory installed nailer strip. Coordinate installation with Division 7.

J. Accessories:

1. Motorized damper in damper tray of roof curb. Actuator shall be same voltage as motor in fan. Damper shall energize fan through integral end switch.

2. Disconnect Switch: Coordinate with Division 26. Provide factory wired disconnect switch on 120v motor only. Factory provided disconnect switches shall be rated for outdoor use. Three phase combination disconnect/starter shall be provided by Division 26.

3. Direct drive units shall be provided with motor speed control option.

2.3 UPBLAST CENTRIFUGAL ROOF FANS - GREASE EXHAUST

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck.
2. Cook.
3. Acme.

B. Unit shall be a low profile, hooded, roof mounted, belt driven or direct drive, propeller ventilator. Coordinate drive with fan schedule on drawings.

C. Unit shall be constructed in accordance with UL 762. Fan shall bear the AMCA certified ratings seal for sound and air performance.

D. Construction: The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The aluminum base shall have sealed curb cap corners by continuous weld or application of butyl tape to inside of the curb cap for maximum leak protection. The windband shall have a rolled bead for added strength. A two-piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. An external wiring compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a 14-gauge steel

power assembly. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. A one (1) inch thick, three-pound density foil back heat shield shall be utilized to protect the motor and drive components from excessive heat. Lifting lugs shall be provided to help prevent damage from improper lifting. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

E. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.

F. Motor: Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase, and enclosure.

G. Bearings: Heavy duty regreasable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours.

H. Dives: Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150 percent of the installed motor horsepower. The variable pitch drive must be factory set to the specified fan RPM.

I. Roof Curb: 12-inch-high of 18-gauge galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2-inch insulation, damper tray, hinged curb adapter for access to dampers, and factory installed nailer strip. Coordinate installation with Division 7.

J. Accessories:

1. Disconnect Switch: Coordinate with Division 26.
2. Direct drive units shall be provided with motor speed control option.
3. Gravity actuated back-draft damper with adjustable counterweight.
4. Provide minimum 10” tall, vented curb extension.
5. Provide grease trap with drain connection.
6. Provide heat baffle.
7. Provide Clean-Out Port.

2.4 CENTRIFUGAL FILTERED SUPPLY FAN - KITCHEN HOOD

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck.
2. Cook.
3. Acme.

B. Unit shall be a low profile, hooded, roof mounted, belt driven or direct drive, propeller supply ventilator. Coordinate drive with fan schedule on drawings.

C. Description: Fan shall be a side intake, roof mounted, belt driven, centrifugal filtered supply fan.

D. Fan shall be constructed in accordance with UL 705. Fan shall bear the AMCA certified ratings seal for air performance.

E. Construction: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18-gauge galvanized steel, bolted to a minimum

16-gauge steel fan base with pre-punched mounting holes. Unit shall be provided with an insulated top cover and 1" washable permanent aluminum filter. Internal blower and motor assembly shall be mounted on rubber vibration isolators. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

F. Wheel: Wheel shall be DWDI centrifugal forward curved type, constructed of painted steel. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

G. Motor: Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase, and enclosure.

H. Bearings: Bearings shall be permanently lubricated, sealed ball type selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

I. Belts and Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

J. Roof Curb: 12-inch-high of 18-gauge galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2-inch insulation, damper tray, hinged curb adapter for access to dampers, and factory installed nailer strip. Coordinate installation with Division 7.

K. Accessories:

1. Motorized damper in damper tray of roof curb. Actuator shall be same voltage as motor in fan. Damper shall energize fan through integral end switch.

2. Disconnect Switch: Coordinate with Division 26. Provide factory wired disconnect switch on 120v motor only. Factory provided disconnect switches shall be rated for outdoor use. Three phase combination disconnect/starter shall be provided by Division 26.

3. Direct drive units shall be provided with motor speed control option.

2.5 INLINE FANS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck.
2. Cook.
3. Acme.

B. Fan shall be a duct mounted, centrifugal, belt driven or direct drive, inline type supply or exhaust ventilator.

C. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

D. Construction: The fan housing shall be of the square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel.

The access panels must be of sufficient size to permit easy access to all interior components. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

E. Coating: For fans serving Natatoriums or corrosive environments provide epoxy coating on all inside and outside surfaces including fan wheel and pulley.

F. Wheel: The fan wheels shall be centrifugal backward inclined, constructed o f aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

G. Motor: Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase, and enclosure. Motor Pulleys shall be adjustable for system balancing.

H. Bearings: Precision ground and polished shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum catalogued operating speed.

I. Drives: Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

J. Accessories:

1. Disconnect Switch: Coordinate with Division 26. Provide factory wired disconnect switch on 120v motor only. Three phase combination disconnect/starter shall be provided by Division 26.

2. Gravity actuated back-draft damper with adjustable counterweight.

3. Direct drive units shall be provided with motor speed control option.

4. Companion Flanges: For inlet and outlet duct connections.

5. Fan Guards: 1/2 by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

6. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify roof curbs are installed, and dimensions are as shown on shop drawings.

3.2 INSTALLATION

A. Secure roof fans with cadmium plated steel lag screws to roof curb structure.

B. Install power ventilators level and plumb.

C. Install dampers in roof curb damper tray.

D. Provide hinged curb adapter to permit access to dampers and duct connection.

E. Install safety screen where inlet or outlet is exposed.

F. Provide sheaves required for final air balance.

G. Install units with clearances for service and maintenance.

H. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.3 CLEANING

A. Vacuum clean inside of fan cabinet.

3.4 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

A. Do not operate fans until ductwork is clean, bearings are lubricated, and fan has been test run under observation.

END OF SECTION 23 34 00

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single duct air terminal units
2. Dual-duct air terminal units
3. Series Fan-Powered Air Terminal Units

B. Related Sections:

1. Section 23 09 23 – Direct Digital Controls: Controls remote from unit.
2. Section 23 09 93 – Sequences of Operation for HVAC System.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.4 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.

1. Air terminal units.
2. Liners and adhesives.
3. Sealants and gaskets.

C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work within shop coordination drawings.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

3. Hangers and supports, including methods for duct and building attachment and vibration isolation.

D. Delegated-Design Submittal:

1. Materials, fabrication, assembly, and spacing of hangers and supports.

E. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

F. Field quality-control reports.

G. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in "Operation and Maintenance Data," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Test and rate air terminal unit performance for air pressure drop, flow performance, and acoustical performance in accordance with ARI 880 and ARI 885. Attach ARI seal to each terminal unit.

C. All electrical components shall be UL Listed and installed in accordance with the National Electric Code. Electrical connections to terminal units shall be single point. The energy terminal shall be UL Listed as a complete assembly.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Filters shall be provided by air terminal unit manufacturer and not by the mechanical contractor.
1. Fan-Powered-Unit Filters: Furnish [one] 1 spare filter(s) for each filter installed.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

1.9 COORDINATION

A. Coordinate Work with Section 23 09 23 - Direct-Digital Control System for HVAC.

1.10 WARRANTY

A. Furnish one (1) year manufacturer warranty for air terminal units. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start up will not be acceptable.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Air Terminal Units shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 SINGLE DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Titus
2. Price
3. Nailor

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Identification: Furnish each air terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

D. Casing: Minimum 22-gauge galvanized steel.

1. Casing Lining: Fiber free, 1/2-inch thick, engineered polyurethane foam, 1.5 lb. / cu. ft. insulation complying with NFPA 90A, UL 181 erosion requirements, UL 181 Mold Growth and Humidity, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84. Exposed fiberglass is not acceptable. The casing shall be designed for hanging by 10-gauge sheet metal hanger brackets for suspending unit with threaded rod.

2. Air Inlets: Round stub connections or oval connections for duct attachment.

3. Air Outlet: S-slip and drive connections.

4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Volume Damper: Heavy gauge galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Velocity Sensors: Multi-point array, center-averaging differential pressure, with velocity sensors in air inlets and air outlets. Sensors that deliver the differential pressure signal from one end of the sensor is not acceptable. Balancing taps and airflow calibration charts shall be provided for field airflow measurements.

G. Actuators shall be capable of supplying at least 35 inches per pound of torque to the damper shaft and shall be mounted externally for service access.

H. Factory installed hydronic heating coils (where scheduled): Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

I. Factory installed Electric-Resistance Heating Coils (where scheduled): Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

1. Provide 480v / 3ph / 60Hz 4W wye single point power connection.
2. Stage(s): Refer to schedule.
3. Access door interlocked non-fused disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
5. Nickel chrome 80/20 heating elements.
6. Airflow switches for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
9. Magnetic contactor for each step of control (for three-phase coils).

J. Factory-Mounted and Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source for terminal units with electric heat.

1. Control Transformer (Required only for terminal units with electric heat): Factory mounted for control voltage. Coordinate equipment voltage requirement with electrical plans.

2. Wiring Terminations: Coordinate required wiring diagrams with Building Automation System controls subcontractor.

3. The following equipment items are to be furnished by Specification Section 23 09 23 - Direct-Digital Controls and installed by air terminal unit manufacturer.

   a. Auto temperature control card (DDC).
   b. 24-volt damper actuator.

4. The following equipment items are to be furnished and installed by the air terminal unit manufacturer:

   a. Volume Control Damper.
   b. Multi-point flow sensor.
   c. Controller enclosure.
   d. Power transformer; required only for terminal units with electric heat. (Coordinate voltage with electrical plans).

K. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

L. Sound Ratings: Not to exceed 35 NC at one (1) inch static pressure. Sound performance shall be ARI certified.

1. Maximum discharge sound power level of 62 DB.
2. Maximum radiated sound power level of 70 DB.
3. DB level based on third octave band.

M. Temperature sensor provided, wired, and installed by Building Automation System Control Contractor: Refer to Section 23 09 23 – Direct Digital Controls.

N. For Sequence of Operation: Refer to Section 23 09 93.

2.2 DUAL-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Titus
2. Price
3. Nailor

B. Configuration: Two volume dampers inside unit casing with mixing attenuator section and control components inside a protective metal shroud.

C. Identification: Furnish each air terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

D. Casing: Minimum 22-gauge galvanized steel.

1. Casing Lining: Fiber free, 1/2-inch thick, engineered polyurethane foam, 1.5 lb. / cu. ft. insulation complying with NFPA 90A, UL 181 erosion requirements, UL 181 Mold Growth and Humidity, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84. Exposed fiberglass is not acceptable. The casing shall be designed for hanging by 10-gauge sheet metal hanger brackets for suspending unit with threaded rod.

2. Air Inlets: Round stub connections or oval connections for duct attachment.

3. Air Outlet: S-slip and drive connections.

4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Volume Damper: Heavy gauge galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.

2. Damper Position: Normally open.

F. Velocity Sensors: Multi-point array, center-averaging differential pressure, with velocity sensors in cold- and hot-deck air inlets and air outlets. Sensors that deliver the differential pressure signal from one end of the sensor is not acceptable. Balancing taps and airflow calibration charts shall be provided for field airflow measurements.

G. Cooling and heating inlets shall have separate damper assemblies for complete pressure independent control of each airstream for variable or constant volume total discharge applications. Terminals with inlet dampers mechanically interconnected are not acceptable. The dampers shall be heavy gauge steel with solid shaft rotating in self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent over-stroking and a synthetic seal to limit close-off leakage.

H. Actuators shall be capable of supplying at least 35 inches per pound of torque to the damper shaft and shall be mounted externally for service access.

I. Factory-Mounted and Wired Controls: Electrical components mounted in control box with removable cover.

1. Wiring Terminations: Coordinate required wiring diagrams with Building Automation System controls subcontractor.

2. The following equipment items are to be furnished by Specification Section 23 09 23 – Direct Digital Controls and installed by air terminal unit manufacturer.

   a. Auto temperature control card (DDC).
   b. 24-volt damper actuator.

3. The following equipment items are to be furnished and installed by the air terminal unit manufacturer:

   a. Volume Control Damper.
   b. Multi-point flow sensor.
   c. Controller enclosure.

J. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

K. Sound Ratings: Not to exceed 35 NC at one (1) inch static pressure. Sound performance shall be ARI certified.

1. Maximum discharge sound power level of 62 DB.
2. Maximum radiated sound power level of 70 DB.
3. DB level based on third octave band.

L. Temperature sensor provided, wired, and installed by Building Automation System Control Contractor: Refer to Section 23 09 23 – Direct Digital Controls.

M. For Sequence of Operation: Refer to Section 23 09 93.

2.3 SERIES FAN-POWERED AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Titus
2. Price
3. Nailor

B. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud for installation above a ceiling.

C. Identification: Furnish each air terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

D. Casing: Minimum 20-gauge galvanized steel.

1. Casing Lining: Fiber free, 1/2-inch thick, engineered polyurethane foam, 1.5 lb. / cu. ft. insulation complying with NFPA 90A, UL 181 erosion requirements, UL 181 Mold Growth and Humidity, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84. Exposed fiberglass is not acceptable. The casing shall be designed for hanging by 10-gauge sheet metal hanger brackets for suspending unit with threaded rod.

2. Air Inlets: Round stub connections or oval connections for duct attachment.

3. Air Outlet: S-slip and drive connections.

4. Access: Removable top and bottom access panels, which allows removal of fan assembly and servicing of terminal without disturbing duct connections; with airtight gasket and quarter-turn latches.

5. Fan: Forward-curved centrifugal; direct-drive.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Volume Damper: Heavy gauge galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Velocity Sensors: Multi-point array, center-averaging differential pressure, with velocity sensors in cold- and hot-deck air inlets and air outlets. Sensors that deliver the differential pressure signal from one end of the sensor is not acceptable. Balancing taps and airflow calibration charts shall be provided for field airflow measurements.

G. Motor:

1. Type: General Electric electronically commutated motor (ECM), variable speed dc brushless. Motor shall be complete and operated by a single-phase integrated controller/inverter that operates the wound stator and senses rotor position to electronically commutate the stator. All motors shall be designed for synchronous rotation. Rotor shall be permanent magnet type with near zero rotor losses. Motor shall have built-in soft start and soft speed change ramps. Motor shall be able to be mounted with shaft in horizontal or vertical orientation. Motor shall be permanently lubricated with ball bearings. Motor shall be directly coupled to the blower. Motor shall maintain a minimum of 70 percent efficiency over its entire operating range. Provide a motor that is designed to overcome reverse rotation and not affect life expectancy.

2. Fan-Motor Assembly Isolation: Rubber isolators.

3. Enclosure: Totally enclosed, air over.

4. Enclosure Materials: Rolled Steel.

5. Motor Bearings: Permanently lubricated ball bearings.

6. Unusual Service Conditions:

7. Efficiency: Premium efficient.

8. NEMA Design: NEMA MG-1.

9. Service Factor: 1.15.

10. Motor Speed: Infinitely adjustable, factory provided and mounted PWM controller for adjustable fan speed control. PWM controller shall be field adjustable with standard screwdriver. Fan CFM shall be pre-set at factory as shown on plans.

11. Electrical Characteristics:

    a. Horsepower: Refer to detail
    b. Volts: 277
    c. Phase: Single.
    d. Hz: 60.

H. Construction Filters for induced air inlet: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Material: Pleated cotton-polyester media having 90 percent arrestance and minimum MERV 8.

2. Thickness: 1 inch.

I. Factory manufactured and mounted Induced air inlet and discharge air attenuator section: steel sheet outer casing, sound absorbing fill material with coating, and inner casing of perforated sheet metal (Provide where scheduled).

1. Lining: Adhesive attached, 3/4-inch thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

J. Factory installed hydronic heating coils (where scheduled): Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

K. Factory installed Electric-Resistance Heating Coils (where scheduled): Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.

1. Provide 277v/ 480v / 3ph / 60Hz 4W wye single point power connection, factory pre-wired for 277v/1ph/60Hz connection to fan.
2. Stage(s): Refer to schedule.
3. Access door interlocked disconnect switch.
4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
5. Nickel chrome 80/20 heating elements.
6. Airflow switches for proof of airflow.
7. Fan interlock contacts.
8. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
9. Magnetic contactor for each step of control (for three-phase coils).

L. Factory-Mounted and Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage. Coordinate equipment voltage requirement with electrical plans.

2. Wiring Terminations: Coordinate required wiring diagrams with Building Automation System controls subcontractor.
3. Disconnect Switch: Factory-mounted, non-fuse type in control panel.
4. The following equipment items are to be furnished by Specification Section 23 09 23 - Direct-Digital Controls and installed by air terminal unit manufacturer.

    a. Auto temperature control card (DDC).
    b. 24-volt damper actuator.

5. The following equipment items are to be furnished and installed by the air terminal unit manufacturer:

    a. Volume Control Damper.
    b. Multi-point flow sensor.
    c. Controller enclosure.
    d. Power transformer (Coordinate voltage with electrical plans).

M. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

N. Sound Ratings: Not to exceed 35 NC at one (1) inch static pressure. Sound performance shall be ARI certified.

1. Maximum discharge sound power level of 62 DB.
2. Maximum radiated sound power level of 70 DB.
3. DB level based on third octave band.

O. Temperature sensor provided, wired, and installed by Building Automation System Control Contractor: Refer to Section 23 09 23 – Direct Digital Controls.

P. For Sequence of Operation: Refer to Section 23 09 93.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install ceiling access doors or locate units above easily removable ceiling components.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Section 232113 "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Connect ducts to air terminal units according to Section 233113 "Metal Ducts."

D. Coordinate duct installations and specialty arrangements with Drawings.

E. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
Perform tests and inspections.

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Air terminal unit will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.

6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

3.8 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to 0 percent full flow. Set units with heating coils for minimum 50 percent full flow.

END OF SECTION 23 36 00

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Air devices.

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings.

2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

C. Test Reports: Rating of air outlet and inlet performance.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Air Devices shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 AIR DEVICES

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Titus
2. Price
3. Nailor

B. Mounting:

1. Plaster Surfaces: Provide with plaster frames or plaster rings to make airtight seal against mounting surface.
2. "T" Bar Ceilings: Lay-in type.
3. Gyp Board and Wall surfaces: 1-1/2" overlap flange.

C. Fire rated diffusers for fire rated roof/ceiling assembly: Refer to diffuser schedule for fire rated assembly requirement.

1. UL classified fire rated ceiling diffuser assembly listed in The Underwriters Laboratories "Fire Resistance Directory".

2. Shall have a fire resistance rating of 3 hours.

3. Heavy Gauge Steel Diffusers shall be tested in accordance with UL 263 and must meet NFPA 90A requirements. Diffusers must be able to operate in (3) three-hour fire rated ceiling and must be installed in accordance with the installation instructions.

4. UL 555C Fire resistance rating: 3-hour ceiling radiation damper with fusible link assembly. Fire closure temperature of 165°F.

5. UL listed thermal blanket insulation and mineral fiber around entire diffuser.

6. Complete fire rated damper assembly with blanket shall be provided and submitted by/with Diffusers, Registers, and Grilles.

D. Source Quality Control

1. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

E. Accessories:

1. Square to round neck adapter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify inlet and outlet locations.

B. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Verify ceiling and wall systems are ready for installation.

E. Refer to Architectural Code Information and Fire Rated Assemblies Drawing to verify if ceiling is fire rated. If ceiling is fire rated provide U.L. tested radiation damper with thermal blanket for all ceiling mounted supply and return air grilles.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00 – Air Duct Accessories.

C. Install diffusers, registers, and grilles level and plumb.

D. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure

drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

E. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

F. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Section 09 91 00.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.5 SCHEDULES:

A. Refer to Drawings.

END OF SECTION 23 37 13

SECTION 23 37 23 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide complete, fully operational fans where indicated on Drawings.

B. Section Includes:

1. Dryer vent roof cap
2. Roof mounted intake hood
3. Roof mounted relief hood

C. Related Sections:

1. Section 23 31 00 - HVAC Duct and Casings: Product requirements for hangers for placement by this section.

2. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

3. Coordinate work in this Section with Division 7.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork, and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturer’s instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705 and UL 762 for kitchen exhaust.

D. Balance Quality: Conform to AMCA 204.

E. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.

1.6 WARRANTY

A. Furnish one (1) year manufacturer's warranty. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start up will not be acceptable.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Ventilators shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS.

2.1 DRYER VENT ROOF CAP

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck
2. Cook

B. Unit shall be a spun aluminum, roof mounted gravity ventilator.

C. Construction: The unit shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16-gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The spun aluminum baffle shall have a rolled bead for added strength. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

D. Roof Curb: 12-inch-high of 18-gauge galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2-inch insulation, damper tray, hinged curb adapter for access to dampers, and factory installed nailer strip. Coordinate installation with Division 7.

E. Accessories: Gravity actuated back-draft damper with adjustable counterweight.

2.2 ROOF MOUNTED INTAKE HOOD

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck.
2. Cook.
3. Acme.

B. Unit shall be an aluminum roof mounted intake hood.

C. Construction: The unit shall be of bolted and welded construction utilizing corrosion resistant fasteners. The aluminum hood shall be constructed of minimum 14-gauge marine alloy aluminum, bolted to a minimum 8-gauge aluminum support structure. The aluminum base shall have sealed curb cap corners by continuous weld or application of butyl tape to inside of the curb cap for maximum leak protection. Birdscreen constructed of 1/2" mesh shall be mounted across the intake opening. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

D. Roof Curb: 12-inch-high of 18-gauge galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2-inch insulation, damper tray, hinged curb adapter for access to dampers, and factory installed nailer strip. Coordinate installation with Division 7.

E. Accessories:

1. Motorized damper in damper tray of roof curb. Actuator shall be low voltage for control wiring from DDC controller. Damper shall include integral end switch.

2.3 ROOF MOUNTED RELIEF HOOD

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Greenheck.
2. Cook.
3. Acme.

B. Unit shall be an aluminum roof mounted relief hood.

C. Construction: The unit shall be of bolted and welded construction utilizing corrosion resistant fasteners. The aluminum hood shall be constructed of minimum 14-gauge marine alloy aluminum, bolted to a minimum 8-gauge aluminum support structure. The aluminum base shall have sealed curb cap corners by continuous weld or application of butyl tape to inside of the curb cap for maximum leak protection. Bird screen constructed

of 1/2" mesh shall be mounted across the intake opening. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

D. Roof Curb: 12-inch-high of 18-gauge galvanized steel construction with continuously welded seams, built-in cant strips, 1-1/2-inch insulation, damper tray, hinged curb adapter for access to dampers, and factory installed nailer strip. Coordinate installation with Division 7.

E. Accessories:

1. Gravity actuated back-draft damper with adjustable counterweight.
2. Motorized damper: actuator shall be low voltage for control wiring from DDC controllers. Damper shall include integral end switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify roof curbs are installed, and dimensions are as shown on shop drawings.

3.2 INSTALLATION

A. Secure intake/relief hoods with cadmium plated steel lag screws to roof curb structure.

B. Install dampers in roof curb damper tray.

C. Provide hinged curb adapter to permit access to dampers and duct connection.

D. Install safety screen where inlet or outlet is exposed.

3.3 MANUFACTURER'S FIELD SERVICES

A. Furnish services of factory trained representative for minimum of one (1) day to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.4 CLEANING

A. Vacuum clean inside of fan cabinet.

3.5 DEMONSTRATION

A. Demonstrate fan operation and maintenance procedures.

3.6 PROTECTION OF FINISHED WORK

A. Do not operate until ductwork is clean, bearings are lubricated, and fan has been test run under observation.

END OF SECTION 23 37 23

SECTION 23 51 00 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Category IV Condensing Appliance double wall metal vents.

B. Related Sections:
1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers and supports for placement by this section.

1.3 REFERENCES

A. Underwriters Laboratories Inc.:
1. UL 103 - Factory-Built Chimneys for Residential Type and Building Heating Appliances.
2. UL 378 - Draft Equipment.
3. UL 441 - Gas Vents.
4. UL 641 - Type L Low-Temperature Venting Systems.
5. UL 959 - Medium Heat Appliance Factory Built Chimneys.

1.4 DESIGN REQUIREMENTS

A. Design refractory lined metal stacks for wind loading of 110 mph.

1.5 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Flue pipe shall be provided and submitted by boiler sales representative submitting on project. Flue pipe shall not be submitted separately by a third party, sheet metal contractor, mechanical contractor, etc.; no exception. Flue piping shall be submitted concurrently, but separately, at the same time as boilers.

C. Manufacturer shall provide a ¼” = 1’-0” scaled drawing within submittal showing flue pipe routing in plan and elevation views. Drawing of flue routing must be provided with dimensions showing code required distances away from intake hoods, intake louvers, etc. Include dimensions from finished roof to top of flue. Flue gasses discharged must not recirculate back into building by winds or inadequate spacing between any building envelope intakes.

D. Product Data: Submit data indicating factory-built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics, and connection requirements.

E. Product Data: Submit data on draft fans and accessories including fan curves with specified operating point plotted, power, RPM, and electrical characteristics and connection requirements.

F. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. All products furnished under this Section shall conform to the requirements of NFPA-211. Products shall be listed to UL-103 and shall carry the appropriate UL and cUL listing mark or label.

B. Flue pipe shall be provided and submitted by boiler manufacturer submitting on project.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Maintain water integrity of roof during and after installation of chimney or vent.

PART 2 - PRODUCTS

2.1 CATEGORY IV CONDENSING APPLIANCE DOUBLE WALL METAL VENTS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Metal-Fab
2. Heat-Fab
3. Simpson Dura-Vent
4. Ampco

B. Fabrication: Inner pipe of sheet AL29-4C and outer pipe of 430 stainless steel, tested in compliance with UL 441.

C. All products furnished under this Section shall conform to the requirements of The National Fuel Gas Code, NFPA-54; and NFPA-211, the Standard for Positive Pressure Condensing Appliances. Products shall be listed to UL-441 and shall carry the appropriate UL or cUL listing mark or label.

D. The vent shall be of the double-wall, factory-built type for use with approved Category IV condensing appliances burning natural or LP gas, which produce flue gases exhausted at temperatures not exceeding 550º F.

E. The vent shall be constructed of an outer wall of 430 stainless steel, .018" thick for sizes 3" to 14" diameter, and .024" thick for sizes 16" to 30"diameter. The inner wall shall be constructed of AL29-4C, .035" thick for sizes 3" to 8" diameter and .048" thick for sizes 10" to 30" diameter. The vent shall include an integral, annular insulating air space, 1/4" thick for sizes 3" to 6" diameter and 1/2" thick for sizes 7" to 30" diameter.

F. Edges of inner and outer walls shall be sealed and joined according to manufacturer installation instructions.

G. All fittings, flashing, storm collar, cap, and appliance adapter required to install the vent shall be included.

H. Vent shall be tested and listed for a minimum clearance to combustibles of 1" for sizes 3" to 24" diameter and 2" for sizes 26" to 30" diameter.

I. Vent shall terminate as required by code.

J. Vent shall be installed in accordance with the vent manufacturer's installation instructions, UL listing and state or local codes.

K. Warranty: Furnish 1-year manufacturer warranty for manufactured units to begin at substantial completion.

L. Accessories, UL labeled:

1. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers and storm collar.

2. Stack Cap: Consists of conical rain shield with inverted cone for partial rain protection with low flow resistance.

3. Exterior pipe and fittings shall be constructed entirely of type 304 stainless steel.

M. Application: Category IV Condensing Gas Appliances.

PART 3 - EXEXCUTION

3.1 PREPARATION

A. Install concrete inserts for support of breeching, chimneys, and stacks in coordination with formwork.

3.2 INSTALLATION - GENERAL

A. Install in accordance with NFPA 54.

B. Install breeching with minimum of joints. Align accurately at connections, with internal surfaces smooth.

C. All double wall gas vents maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories for complete installation.

D. Install vent dampers, locating close to draft hood collar, and secured to breeching.

E. Assemble and install stack sections in accordance with NFPA 82, industry practices, and in compliance with UL listing. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

F. Level and plumb chimney and stacks.

G. Clean breeching, chimneys, and stacks during installation, removing dust and debris.

H. Install slip joints allowing removal of appliances without removal or dismantling of breeching, breeching insulation, chimneys, or stacks.

I. Provide the appropriate and/or applicable chimney system continuous from appliances.

3.3 BOILER STACK

A. Installation shall conform to the manufacturer's installation instructions, UL listing and state or local codes.

B. Support system from building structure using rigid structural shapes for attachment of fixed point supports (Plate Support Assembly). Anchor supports to structure by welding to inserts, bolting, steel expansion anchors or concrete inserts. Size of structural shapes shall be in accordance with manufacturer's recommendations.

C. Protect incomplete installations by attaching temporary closures over open ends of sections.

D. Clean all system sections of dust and debris prior to final connection to appliances.

E. Maximum unsupported horizontal spacing shall be nine (9) feet between guides.

F. Maximum unsupported vertical spacing shall be 19 feet between guides.

G. Pipe to be routed to minimize flow resistance.

H. Provide double wall bellows joint between each support and for every three (3) inches of expected expansion.

I. Provide support at roof penetration to support free standing of exhaust above roof and to keep stack centered in ventilated thimble assembly.

J. Provide drain bucket at bottom of vertical stack, piped to nearest floor drain.

K. Provide ventilated thimble and storm collar at roof penetration.

L. Provide flip top fitting at stack termination or engine exhaust.

M. Provide stack cap on boiler stack termination.

END OF SECTION

EQUIPMENT SHALL BID AS AN ALTERNATE

SECTION 23 52 16 - CONDENSING BOILER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Heating water boiler heat exchanger.
2. Boiler control panel.
3. Hot water boiler trim.
4. Natural gas fired burner.

B. Boiler shall be completely factory assembled and tested on a structural steel base and be ready for water, gas, and electric connections.

C. Boiler and all components shall be CSA certified.

1. ASME Section IV (Heating Boilers)
2. ANSI Z21.13 / CSA 4.9 (Gas Fired Low Pressure Boilers)
3. NFPA 54 (ANSI Z221.3)National Fuel Gas Code
4. ASME CSD-1 (Controls and Safety Devices)

D. Related Sections:

1. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolators for placement by this section.

2. Section 23 11 23 - Gas Piping: Execution requirements for gas piping connections to boilers specified in this section.

3. Section 23 51 00 - Breechings, Chimneys, and Stacks: Execution requirements for breeching, chimney, and stack connections to boilers specified in this section.

4. Division 26 - Wiring Connections: Execution requirements for electric connections to boilers specified in this section.

1.3 REFERENCES

A. ASME Section IV (Heating Boilers)

B. ANSI Z21.13/CSA 4.9 (Gas Fired Low Pressure Boilers)

C. NFPA 54 (ANSI Z221.3) National Fuel Gas Code

D. ASME CSD-1 (Controls and Safety Devices)

EQUIPMENT SHALL BID AS AN ALTERNATE

1.4 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Flue pipe as specified per 23 51 00 Breechings, Chimneys, and Stacks, shall be provided, and submitted by boiler sales representative submitting on project. Flue pipe shall not be submitted separately by a third party, sheet metal contractor, mechanical contractor, etc.; no exception. Flue piping shall be submitted concurrently, but separately, at the same time as boilers.

C. Product Data: Submit capacities and accessories included with boiler. Include general layout, dimensions, size and location of water, fuel, electric and vent connections, electrical characteristics, weight, and mounting loads.

D. Test Reports: Indicate boilers meet or exceed specified performance and efficiency. Submit results of combustion test.

E. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Manufacturers Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

1.6 QUALITY ASSURANCE

A. Conform to ASME Section IV for construction of boilers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

B. Gas Train and Safety Controls: Industrial Risk Insurers.

C. Unit Certification: CSA certified.

D. Boilers shall comply with 2012 International Energy Conservation Code.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Boilers shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water

migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

1.9 WARRANTY

A. The boiler manufacturer shall provide an entire boiler parts and labor warranty (including circulating pump) for a period of five (5) years. Warranty shall begin from date of Certificate of Substantial Completion. Provide manufacturer's warranty certificates as described below. Warranty start dates from shipment or startup will not be accepted.

B. Provide an extended parts warranty for the following:

1. Thermal shock: From years (6) six through (10) ten years from date of substantial completion.

C. In addition to entire parts and labor warranty, the Standard and Extended warranty shall include miscellaneous materials, travel time, incidental expenses, normal freight/shipping, and any expenses related to service calls required to diagnose and correct warranty issues.

D. The manufacturer shall provide factory certificates for each boiler listing at a minimum the model, serial number, and warranty information as specified above. Payment to contractor may be held if warranty certificates are not provided in a timely manner.

E. All warranty work shall be performed by factory direct service technician. Warranty work shall not be performed by installing mechanical contractor or third party.

1.10 GENERAL

A. Each factory "packaged" boiler shall be complete with all components, accessories, and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.

B. Each factory "packaged" boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

PART 2 – PRODUCTS

2.1 CONDENSING WATER BOILERS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Refer to Specification 01 23 00 Alternates for acceptable manufacturers.

2. All materials and labor costs to coordinate, receive, install and start-up the equipment per this specification for a complete and operational system shall be included in the Contractor's Base Bid.

B. Boiler shall be fire-tube condensing type.

C. Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified efficiency of not less than 97 % on 500 MBH input boilers and less and not less than 97% on larger than 500 MBH input boilers. Each boiler shall be capable of operating with a minimum outlet water temperature of 68º F.

D. Boiler shall comply with ASME Section IV for 80 psig, max 200º F (100 psig on 1500 MBH and larger units).

E. Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu Ft and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5 in.wc. to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14 in.wc.

2.2 BOILER DESIGN

A. Each hot water boiler shall consist of a stainless-steel or cast-iron primary only heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified. Boilers requiring a secondary heat exchanger (economizer) to achieve condensing operation will not be permitted as well as copper-finned heat exchangers.

B. Each boiler heat exchanger shall be stainless-steel or cast iron, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced flow through each section.

C. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.

EQUIPMENT SHALL BID AS AN ALTERNATE

D. All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped.

E. Boiler heat exchanger headers shall be fabricated steel and be completely removable for inspection. Seals shall be EPDM, rated for 400 deg F service. Push nipples or gaskets between the sections are not permitted.

F. Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from minimum 16-gauge carbon steel. The front and top wall shall be secured in place with ¼ - 20 NC bolts (sheet metal screws are not acceptable). The complete outer casing shall be finished, inside and out, with a powder coat finish. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50^{o}F above ambient temperature when the boiler is operated at full rated load.

G. An observation port shall be located on the boiler to allow for observation of the burner flame.

H. Flue gas outlet shall be located on the rear of the boiler. Boiler to be certified for installation with Category IV venting (stack) as defined in NFPA 54 (ANSI Z221), latest edition. Contractor must provide venting (stack) certified for installation on a Category IV appliance.

2.3 BOILER TRIM

A. Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows:

1. Safety relief valve shall be provided in compliance with the ASME code. Contractor to pipe to acceptable drain.

2. Water pressure-temperature gauge.

3. Primary low water flow fuel cutoff (probe type with manual reset).

4. Manual reset high limit water temperature controller.

5. Operating temperature control to control the sequential operation of the burner.

2.4 BOILER FUEL BURNING SYSTEM

A. The boiler manufacturer shall furnish each boiler with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system. The burner manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

B. Each burner shall be provided with an integral gas firing combustion head.

C. Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.

D. Each boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient

capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall be a maximum of 900 watts and operate at 6,000 RPM maximum without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the LED display.

E. Each burner shall of the radial-fired (down-fired) type and constructed of steel with a stainless-steel inner and stainless-steel mesh outer screen.

F. Each boiler shall be provided with a “Full Modulating” firing control system whereby the firing rate is infinitely proportional at any firing rate between 20% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.

G. The Microprocessor shall use a Proportional Integral Algorithm to determine the firing rate. The control must have the following capabilities:

1. Maintain single set point.

2. Reset the set point based on outdoor air temperature.

3. Boiler shutdown based on outdoor air temperature.

4. Internal dual set point program with an external switchover. (e.g. - night setback w/external clock, supplied by others)

5. Alarm relay for any manual reset alarm function.

6. Programmable Low Fire Delay to prevent short cycling based on a time and temperature factor for release to modulation.

7. LED Display showing current supply and return temperatures, current set points as well as differential set points. It must also display any fault codes whether automatically reset or manually reset.

8. Local Manual Operation.

9. Remote Control System (Building Management / Sequencer Control) - The boiler control shall be capable of accepting a 0 -10vdc remote external analog signal to control the firing rate.

10. Computer (PC) interface for programming and monitoring all functions.

2.5 MAIN GAS VALVE TRAIN

A. Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:

EQUIPMENT SHALL BID AS AN ALTERNATE

1. Two (2) safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing.
2. Air – Gas ratio control (maximum inlet pressure 14 in.wc.)
3. One (1) low gas pressure switch (manual reset).
4. One (1) high gas pressure switch (manual reset).
5. Two (2) pressure test ports.

2.6 IGNITION SYSTEM

A. Each boiler shall be equipped for direct spark ignition.

2.7 COMBUSTION AIR CONTROL

A. Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:

1. The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.

2. One (1) low airflow differential pressure switch to ensure that combustion air is supplied.

3. High exhaust back pressure switch

2.8 BURNER CONTROL SYSTEM

A. The control system shall be supplied with a 24 VAC transformer (120 VAC, single phase, 60 hertz primary). The 120/1/60 power supply to each boiler shall be protected by a 15 Amp circuit breaker located in the MCC (supplied by contractor).

B. The boiler shall include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod (rectification) system.

C. Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.

D. Each boiler control system shall provide timed sequence pre-ignition air purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

2.9 BURNER CONTROL PANEL

A. The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:

1. One (1) burner "on-off" switch.

2. One (1) electronic combination temperature control, flame safeguard and system control.

EQUIPMENT SHALL BID AS AN ALTERNATE

3. Control circuit breaker, 5 amp

4. All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.

5. LED Display Panel to adjust set points and control operating parameters. LED display to indicate burner sequence, all service codes (0-65), fan speed, boiler set point, and sensor values such as inlet, outlet, flue gas and outdoor air.

2.10 BUILDING AUTOMATION SYSTEM INTERFACE:

A. Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.

1. A BACnet communication interface card with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed locally at boiler control panel shall be available through building automation system.

2.11 FACTORY TESTING – HYDROSTATIC

A. Each factory "packaged" boiler shall be hydrostatically tested and bear the ASME “H” stamp.

2.12 FACTORY TESTING – FIRE TESTING

A. Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install boilers plumb and level, to plus or minus 1/16 inch over boiler base. Stacking of boilers is unacceptable.

B. Maintain manufacturers recommended and code minimum clearances around and over boilers.

C. Install boiler on concrete housekeeping pad, minimum four (4) inches high and six (6) inches larger than boiler base on each side. Refer to Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

D. Install boiler on vibration isolators in accordance with Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

E. Connect natural gas piping in accordance with NFPA 54.

F. Connect natural gas piping to boiler, full size of boiler gas train inlet. Arrange piping with clearances and unions for burner removal and service.

EQUIPMENT SHALL BID AS AN ALTERNATE

G. Connect hot water piping to supply and return boiler connections.

H. Install the following piping accessories. Refer to Section 23 05 19 - Meters and Gages for HVAC Piping.

1. On supply:

a. Thermometer well for temperature controller.
b. Thermometer well and thermometer.
c. Well for control system temperature sensor.
d. Strainer.
e. Nipple and flow switch.
f. Pressure gage.
g. Shutoff valve.

2. On return:

a. Thermometer well and thermometer.
b. Well for control system temperature sensor.
c. Pressure gage.
d. Shutoff valve.
e. Balancing valve.

I. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 23 - Gas Piping.

1. Strainer.
2. Pressure gage.
3. Shutoff valve.
4. Check valve.
5. Pressure reducing valve.
6. Unions.

J. Install discharge piping from relief valves and drain valves to nearest floor drain.

K. Install boiler trim and accessories furnished loose for field mounting.

L. Install electrical devices furnished loose for field mounting.

M. Install control wiring between boiler control panel and field mounted control devices.

N. Connect flue to boiler outlet, full size of outlet.

O. Route each gas trim vent, separately, to the outdoors. Vent lines sizes shall be a minimum the equivalent size pipe connection. Provide union at each device to facilitate change-out and in the vertical to allow the burner door to swing open. Terminate vents a sufficient distance from air intakes, turn down and provide insect screen.

P. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.

EQUIPMENT SHALL BID AS AN ALTERNATE

3.2 FIELD QUALITY CONTROL

A. Perform combustion test including boiler firing rate, over fire draft, gas flow rate, heat input, burner manifold gas pressure, percent carbon monoxide, percent NOx, percent oxygen, percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output. Perform test at minimum, mid-range, and high fire.

B. Arrange with local authorities having jurisdiction for inspection of boiler, piping, and for certificate of operation. Provide written certification from boiler manufacturer that installation is in compliance with manufacturer's written instructions.

C. Prior to boiler startup, Contractor to inform Owner to have boiler inspector inspect installation for proper installation and submit for State Operating Certificate.

3.3 BOILER INSPECTION REQUIREMENTS

A. All new boilers, regardless of new construction or renovation of existing systems, are required to receive inspection by a state boiler inspector or their assigned agent prior to any boiler being energized, no exceptions. A boiler requiring inspection is generally defined by the following characteristics.

1. Heat input exceeds 200,000 Btuh.
2. Nominal water-containing capacity exceeds 120 gallons.

B. As per Boiler Safety Administration Rules, 65.20, The Owner or operator are the only persons that can submit a request for inspection of a boiler by the state or their agent. The inspection agent has at least 30 days to schedule an inspection date with the Owner. During an emergency situation where a boiler is replaced due to mechanical failure of an existing boiler, the agent may grant approval to the Owner to allow startup before inspection but that is at the agent’s discretion.

C. The installing contractor is required to submit the following documents to the Owner before the Owner can submit for state inspection.

1. Contractor shall complete the attached Boiler Inspection Installation Report and notify the district HVAC department personnel in charge of maintaining all inspection certification documentation for the district.

2. Contractor shall submit all manufacturer’s cut sheets and product information on boiler being inspected.

3. Hydrostatic test results on boiler being inspected.

4. Contractor shall submit this information to the Owner in a timely manner so the inspection can be scheduled and performed prior to project completion.

D. As per the Health and Safety Code, Chapter 755, September 1, 2003.

1. Nuclear, high pressure or steam boilers must receive an annual certificate of inspection and an annual external inspection if they meet these characteristics.

a. Pressures exceeding 160 psi.
b. Temperatures exceeding 250 degrees Fahrenheit

EQUIPMENT SHALL BID AS AN ALTERNATE

2. Steam heating boilers and hot water heating boilers shall be inspected biennially (every two years) if they meet these characteristics:

   a. Pressures not exceeding 160 psi.
   b. Heat input exceeds 200,000 Btuh.
   c. Water temperature greater than 210 F but not greater than 250 degrees Fahrenheit
   d. Nominal water-containing capacity exceeds 120 gallons.

3. Hot water supply boilers shall be inspected triennially (every three years) if they meet these characteristics:

   a. Pressures not exceeding 160 psi.
   b. Heat input exceeds 200,000 Btuh.
   c. Water temperature not exceeding 210 degrees Fahrenheit; or Nominal water-containing capacity exceeds 120 gallons.

E. Inspection Responsibilities

1. Preparing the boiler for inspection is listed in the Boiler Safety Administrative Rules, Section 65.70.

   a. Water shall be drawn off and the boiler thoroughly washed.

   b. All manhole and hand hole plates, washout plugs, and plugs in the water column connections shall be removed as necessary for complete inspection. The furnace and combustion chambers shall be thoroughly cooled and cleaned.

   c. All grates and internally fired boilers shall be removed.

   d. Brickwork shall be removed as required by the inspector in order to determine the condition of the boiler, headers, furnace, supports or other parts.

   e. The pressure gage shall be removed for cleaning of the siphon and testing, if necessary.

   f. The low water cutoff device shall be dismantled, cleaned, and prepared for inspection.

   g. Before removing the manhole or hand hole covers and entering any part of the boiler connected to a common header with other boilers any leakage of steam or hot water shall be eliminated. The non-return and stop valves must be closed, tagged, and preferably padlocked, and drain valves between the two valves opened. The feed water valves must be closed, tagged, and preferably padlocked. After draining the boiler, the blowdown valves shall be closed and preferably padlocked. Blowdown lines, where practicable, shall be disconnected between pressure parts and valves. All vent and drain lines shall be opened.

   h. If the boiler is jacketed so that the seams of shells, drums or domes cannot be seen, enough of the jacketing, setting wall, or other form of casing or housing shall be removed to permit inspection to determine the

safety of the boiler, provided such information cannot be determined by other means.

2. For initial boiler inspection after installation:

   a. Once an inspection date has been established between the inspector and Owner, the boiler manufacturer's representative shall be available on-site for boiler inspection.

   b. The manufacturer's representative shall make the boiler available for inspection as per procedures listed above or tests as required by the inspector.

   c. The manufacturer's representative will be responsible to re-assemble boiler back to its original state and then schedule a startup test with the installing contractor and Owner. All product warranties shall begin once startup has been completed and unit is available for use as designed.

3. For annual boiler inspection:

   a. Once an inspection date has been established between the inspector and Owner, the Owner or their assigned contractor shall be available on-site for boiler inspection.

   b. The Owner or their assigned contractor shall make the boiler available for inspection as per procedures listed above or tests as required by the inspector.

   c. The Owner or their assigned contractor will be responsible to re-assemble boiler back to its original state and place the boiler in good working condition.

3.4 MANUFACTURER'S FIELD SERVICES

A. Start-up boilers according to manufacturer's start-up instructions and in presence of boiler manufacturer's representative and Owner's representative. Test controls and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment.

3.5 CLEANING

A. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.

3.6 DEMONSTRATION

A. Demonstrate operation and maintenance procedures.

B. Furnish services for manufacturer's technical representative for one (1) 8-hour day to instruct Owner's personnel in operation and maintenance of boilers. Schedule training with Owner, provide at least seven (7) days notice to Architect/Engineer of training date.

EQUIPMENT SHALL BID AS AN ALTERNATE

END OF SECTION 23 52 16

SECTION 23 55 33.16 - GAS-FIRED UNIT HEATERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gas-fired unit heaters.
B. Related Sections:

1. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolators for placement by this section.

2. Section 23 11 23 - Gas Piping: Execution requirements for gas piping connections to boilers specified in this section.

3. Section 23 51 00 - Breechings, Chimneys, and Stacks: Execution requirements for breeching, chimney, and stack connections to boilers specified in this section.

4. Division 26 - Wiring Connections: Execution requirements for electric connections to boilers specified in this section.

1.3 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: For each type of gas-fired duct heater indicated. Include rated capacities, operating characteristics, and accessories.

C. Shop Drawings: Include plans, elevations, sections, and details.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired duct heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 WARRANTY

A. Furnish a five (5) year manufacturer warranty. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start-up will not be acceptable.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Gas-fired unit heaters shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

1.9 EXTRA MATERIALS

A. Furnish two (2) throwaway filters for each unit.

PART 2 - PRODUCTS

2.1 GAS FIRED UNIT HEATERS

A. Manufacturers: Subject to compliance with scheduled efficiencies, capacities, and specification, provide products by the following manufacturers.

1. Reznor
2. Modine
3. Detroit Radiant Products Co. / Re-Verber-Ray Infrared
4. Sterling

B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:

1. Heating fuel: Natural gas fired.

2. Discharge Louvers: Individually adjustable horizontal louvers to match cabinet finish.

3. Downturn Nozzle: [30] [60] degree nozzle to match outlet and cabinet finish.

4. Gas Control: Two stage.

5. Ignition System: Electric direct ignition.

6. Control Voltage: 24-volt, 60 hertz.

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7. Location: Suspended overhead.

C. Cabinet: 20-gauge galvanized steel, easily removed and secured access panels, insulated or double panel construction.

D. Supply Fan: Propeller type with direct drive.

E. Heat Exchanger: 20-gauge aluminized steel tubes with 18-gauge aluminized steel headers.

F. Gas Burner: Power-vented with non-corrosive air blower with permanently lubricated motor.

G. Gas Burner Safety Controls:

1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.

2. Flame rollout switch: Installed on burner box and prevents operation.

3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

4. Limit Control: Fixed stop at maximum permissible setting de-energizes burner on excessive bonnet temperature, automatic reset.

H. Controls:

1. Room Thermostat: Adjustable, low voltage, to control heater stages in sequence with delay between stages, and supply fan to maintain temperature setting. Include system selector switch (heat-off-cool) and fan control switch (auto-on).

2. Supply Fan Control: Energize either from discharge temperature independent of burner controls or with timed off delay and timed on delay. Furnish manual switch for continuous fan operation. Provide continuous low speed fan operation.

I. Performance:

1. Thermal efficiency rating at maximum and minimum rated capacity in accordance with ANSI Z83.8 and ASHRAE 90.1 and International Energy Conservation Code.

2. Provide equipment as scheduled on Drawings.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.

1. Spring hangers are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" and Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Maintain manufacturers' recommended clearances to combustibles.

3.2 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems.

B. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to gas-fired duct heaters to allow service and maintenance.

D. Connect natural gas piping in accordance with NFPA 54.

E. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

F. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 23 - Gas Piping.

1. Strainer.
2. Pressure gage.
3. Shutoff valve.
4. Pressure reducing valve.

G. Vent Connections: Comply with Section 23 51 00 "Breechings, Chimneys, and Stacks."

H. Electrical Connections: Comply with applicable requirements in electrical Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

   2. Verify bearing lubrication.

   3. Verify proper motor rotation.

   4. Test Reports: Prepare a written report to record the following:

      a) Test procedures used.
      b) Test results that comply with requirements.
      c) Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired radiant heaters.

END OF SECTION 23 55 33.16

SECTION 23 63 13 - AIR-COOLED REFRIGERANT CONDENSERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes refrigerant condenser package, charge of refrigerant and oil, controls and control connections, refrigerant piping and connections, motor starters, electrical power connections.

B. Related Sections:

1. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolation for placement by this section.

2. Section 23 00 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.

1.3 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils.

1.4 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Provide line-by-line equipment schedule note review annotated to certify compliance or deviation.

C. Product Data: For each air-cooled refrigerant condenser. Include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights, and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Shop Drawings: For air-cooled refrigerant condensers. Include plans, elevations, sections, details, and attachments to other work.

a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

b. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which air-cooled refrigerant condensers will be attached.
2. Liquid and vapor pipe sizes.
3. Refrigerant specialties.
4. Piping including connections, oil traps, and double risers.
5. Evaporators.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-cooled refrigerant condensers to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

C. Coordinate location of refrigerant piping and electrical rough-ins.

1.9 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer’s protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic

materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

E. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

F. Protect units from physical damage. Leave factory covers in place until startup of machine.

1.11 WARRANTY

A. The manufacturer shall provide a full machine parts, labor, and refrigerant warranty for a period of one (1) year. Warranty shall begin from date of Certificate of Substantial Completion. Provide manufacturer's warranty certificates as described below. Warranty start date from shipment or start up will not be acceptable.

B. Provide an extended four (4) year FULL machine parts, labor, and refrigerant warranty for Air Cooled Condensing Units. All Air-Cooled Condensing Unit components to be included such as but not limited to refrigerant, compressors, fans, condenser coils, motors, and controller. In the event of failure, the manufacturer shall provide a new motor, compressor, fan, controller, etc. Local or field rebuilt motors, compressors, drive controllers etc. are not acceptable.

C. In addition to full machine parts, labor and refrigerant, the Standard and Extended warranty shall include miscellaneous materials, travel time, incidental expenses, normal freight/shipping, refrigerant, oils, lubricants, belts, filters, insulation, and any expenses related to service calls required to diagnose and correct warranty issues.

D. The manufacturer shall provide factory certificates for each condensing unit listing as a minimum the model, serial number, and warranty information as specified above. Payment to contractor may be held if warranty certificates are not provided in a timely manner.

E. All warranty work shall be performed by factory direct service technician. Warranty work shall not be performed by installing mechanical contractor.

PART 2 - PRODUCTS

2.1 AIR-COOLED REFRIGERANT CONDENSERS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Refer to Specification 01 23 00 Alternates for acceptable manufacturers.

2. All materials and labor costs to coordinate, receive, install and start-up the equipment per this specification for a complete and operational system shall be included in the Contractor's Base Bid.

B. Product Description:

1. Self-contained packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, condensing coil and fans, compressors, and controls. Each unit shall consist of hermetic scroll compressor air-cooled condenser section.

2. Construction and Ratings: In accordance with ARI 210/240. Testing in accordance with ASHRAE 20.

3. Air-Cooled Refrigerant Condensing units shall be the same manufacturer as associated Air Handling Unit or Fan Coil Unit. Mismatched equipment is not acceptable.

2.2 UNIT IDENTIFACTION REQUIREMENTS

A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:

- Unit identification as indicated within Contract Documents.
- Serial Number.
- Model Number.
- Nominal tonnage.
- Motor Horsepower.
- Unit Power Supply: Volts / PH / Amps; MCA / MOCP
- Refrigerant type.
- Sales Order #.
- Date of unit manufactured.

2.3 HOUSING

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel with full opening access doors. Furnish mechanical interlock to disconnect power when door is opened.

C. Furnish removable access doors or panels with quick fasteners. Units over 25 tons shall be provided with piano hinges and quick fasteners.

D. Furnish welded steel floor mounting stand and duct collars at coil inlet and fan outlet.

2.4 CONDENSER COILS

A. Aluminum Microchannel in galvanized steel casing with equalizing-type vertical distributor.

B. Compressors:

1. Scroll type, hermetically sealed.
2. Minimum of 2 compressors.

3. Refrigerant shall be R-32 or R-454b.
4. All scroll compressors shall include Internal Pressure Relief as standard.
5. For each compressor provide starter, non recycling compressor overload, starter relay, and control power transformer or terminal for control power. Provide manual reset current overload protection.

C. Provide variable speed or digital scroll compressors on lead circuit to allow compressors to operate at low load conditions.

D. Unit shall be able to operate down to 10 degrees Fahrenheit ambient temperature as standard.

E. Coil Guard: louvered with lint screens.

F. Configuration: Two refrigeration circuits each with receiver.

2.5 REFRIGERANT CIRCUIT

A. Single Compressor: One refrigerant circuit with single compressor.

B. Multiple compressors: Provide with multiple refrigerant circuits. Minimum of two (2) circuits.

C. Furnish for each refrigerant circuit:

1. Liquid line solenoid valve.
2. Filter dryer (replaceable core type without refrigerant loss or removal).
3. Liquid line sight glass and moisture indicator.
4. Electronic expansion valve.
5. Charging valve.
6. Insulated suction line.
7. Discharge line check valve.
8. Compressor discharge service valve.
9. Condenser Pressure relief valve.
10. Suction and liquid line service valves.

2.6 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge, equipped with roller or ball bearings with grease fittings extended to outside of casing.

B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built-in current and thermal overload protection.

2.7 CONTROLS

A. Factory wired and mounted control panel, NEMA 3R, containing fan motor starters, fan cycling thermostats, head pressure controls, compressor interlock and control transformer.

B. Furnish controls to permit operation down to 10 degrees Fahrenheit ambient temperature.

C. Furnish thermostat to cycle fan motors in response to outdoor temperature.

D. Furnish head pressure switch to cycle fan motors in response to refrigerant condensing pressure.

E. Furnish solid state control to vary speed of one condenser fan motor in response to refrigerant condensing pressure.

F. Furnish electronic low ambient control consisting of mixing damper assembly, controlled to maintain constant refrigerant condensing pressure.

G. Furnish following safety controls arranged so that operating anyone will shut down machine:

1. High discharge pressure switch (manual reset).
2. Low suction pressure switch (automatic reset).
3. Oil pressure switch (manual reset).
4. Provide a timed off cycle.

2.8 CONDENSING UNIT PERFORMANCE

A. Provide equipment with capacity as scheduled on Drawings.

2.9 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: Provide equipment with electrical characteristics as shown on Electrical Drawings.

B. Disconnect Switch: Coordinate with Division 26, Electrical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with ASHRAE 15.

B. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

C. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties specified in Section 23 23 00 - Refrigerant Piping.

D. Install connection to electrical power wiring in accordance with Division 26.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Install units on vibration isolators on 4” tall concrete housekeeping pad. Refer to 23 05 29 Hangers and Supports for HVAC Piping and Equipment and 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment.

3.3 MANUFACTURER’S FIELD SERVICES

A. Furnish cooling season start-up and winter season shutdown service, for first year of operation. If initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

3.4 DEMONSTRATION AND TRAINING

A. Demonstrate starting, maintenance, and operation of unit.

B. Demonstrate low ambient operation during winter testing or service specified above.

END OF SECTION 23 63 13

EQUIPMENT SHALL BID AS AN ALTERNATE

SECTION 23 64 27 - ROTARY-SCREW WATER CHILLERS AIR-COOLED

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide a complete operational Rotary-Screw Water Chiller.

B. Related Sections:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. Section 23 90 00 "Refrigerant Detection Monitoring System" for refrigerant monitors, alarms, supplemental breathing apparatus, and ventilation equipment interlocks.

3. Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment - Product requirements for Vibration Isolators for placement by this section.

4. Section 23 05 19 Meters and Gages for HVAC Piping: Product requirements for piping specialties for placement by this section.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.

E. kW/Ton (kW/kW): The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons (kW) at any given set of rating conditions.

F. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

EQUIPMENT SHALL BID AS AN ALTERNATE

1.4 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 550/590 - Water Chilling Packages Using the Vapor Compression Cycle.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

2. ASHRAE 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.

C. American Society of Mechanical Engineers:

1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. Underwriters Laboratories Inc.:

1. UL 1995 - Heating and Cooling Equipment.

1.5 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Provide line-by-line schedule notes review annotated to certify compliance or deviation.

C. Shop Drawings: Indicate components, assembly, dimensions, weights, and loads, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

D. Product Data: Submit rated capacities, specialties and accessories, electrical requirements, and wiring diagrams.

E. Design Data: Indicate energy input versus cooling load output from 25 to 100 percent of full load at specified and minimum condenser water temperature.

F. Test Reports: Indicate results of factory performance test.

G. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

H. Manufacturer's Certificate: Certify products meet or exceed specified requirements including components not produced by manufacturer.

I. Manufacturer’s Field Reports: Submit start-up report for each unit. Indicate results of leak test and refrigerant pressure test.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

EQUIPMENT SHALL BID AS AN ALTERNATE

1. Structural supports.

2. Piping roughing-in requirements.

3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.

4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

B. Certificates: For certification required in "Quality Assurance" Article.

C. Source quality-control reports.

D. Startup service reports.

E. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble- shooting guide.

1.8 QUALITY ASSURANCE

A. ARI Certification: Certify chiller according to ARI 550 certification program.

B. ARI Rating: Rate chiller performance according to requirements in ARI 550/590.

C. ASHRAE Compliance:

1. ASHRAE 15 for safety code for mechanical refrigeration.

2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

E. ASME Compliance: Fabricate and label chillers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1[, as applicable to chiller design]. For chillers charged with R-134a refrigerant, include an ASME U-stamp and nameplate certifying compliance.

F. Comply with NFPA 70.

G. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

B. If chiller is mounted on structural-steel support structure coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

1.10 WARRANTY

A. The chiller manufacturer shall provide a full machine parts, labor, and refrigerant warranty for a period of one (1) year. Warranty shall begin from date of Certificate of Substantial Completion. Provide manufacturer's warranty certificates as described below. Warranty start dates from shipment or startup will not be accepted.

B. Provide an extended four (4) year FULL machine parts, labor, and refrigerant warranty for chillers. All chiller components to be included such as but not limited to refrigerant, compressors, motors, starters, variable frequency drives, condenser coils, evaporator coils, fans, controls, and gear assemblies (as applicable) etc. In the event of failure, the chiller manufacturer shall provide a new motor, compressor, drive assembly, etc. Local or field rebuilt motors, compressors, drive assemblies etc. are not acceptable.

C. In addition to full machine parts, labor and refrigerant, the Standard and Extended warranty shall include miscellaneous materials, travel time, incidental expenses, normal freight/shipping, refrigerant, oils, lubricants, belts, filters, insulation, and any expenses related to service calls required to diagnose and correct warranty issues.

D. All components replaced through the warranty process shall be new and not used or re-built.

E. The manufacturer shall provide factory certificates for each chiller listing as a minimum the model, serial number, and warranty information as specified above. Payment to contractor may be held if warranty certificates are not provided in a timely manner.

F. All warranty work shall be performed by factory direct service technician. Warranty work shall not be performed by installing mechanical contractor.

G. Provide quarterly inspections, four (4) per year, by factory direct technician. Provide the owner a minimum of one week's notice prior to inspection.

1.11 PREVENTATIVE MAINTENANCE SERVICE

A. Furnish service and maintenance of chillers for period of five (5) years from Date of Substantial Completion. Preventative Maintenance start dates from shipment or startup will not be accepted.

B. Include, on a quarterly basis, systematic examination, required adjustments, lubrication of unit and controls calibration. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use new parts produced by manufacturer of original equipment.

C. Perform work without removing units from service during building normal occupied hours. Off-line chiller work must be coordinated with Owner.

D. At no additional cost to owner provide emergency call back service at all hours during this maintenance period.

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E. Maintain locally adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

F. All maintenance work shall be performed by factory direct service technician. Maintenance work shall not be performed by installing mechanical contractor.

G. Do not assign or transfer maintenance service to agent or subcontractor.

H. Provide 3 quarterly unit inspections per year.

I. Provide 1 annual unit inspection per year to include:

1. Provide oil analysis at year 1 and at year 4.

2. Condenser coil brushing each year (five total).

3. Provide evaporator tube eddy current testing at year 3.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Chillers shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer’s protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer’s original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

E. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

F. Protect units from physical damage. Leave factory covers in place until startup of machine.

EQUIPMENT SHALL BID AS AN ALTERNATE

PART 2 – PRODUCTS

2.1 ROTARY-SCREW WATER CHILLERS AIR-COOLED

A. Acceptable Manufacturers: Subject to compliance with specification and mechanical drawing requirements, provide products by one of the following:

1. Refer to Specification 01 23 00 Alternates for acceptable manufacturers.

2. All materials and labor costs to coordinate, receive, install and start-up the equipment per this specification for a complete and operational system shall be included in the Contractor's Base Bid.

B. Product Description: Factory assembled and tested, packaged air-cooled liquid chiller consisting of semi-hermetic rotary screw or hermetic scroll compressors, suction gas-cooled compressor motor, condenser coils, evaporator, refrigeration accessories and control cabinet with single point power connection.

2.2 UNIT IDENTIFACTION REQUIREMENTS

A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:

- Unit identification as indicated within Contract Documents.
- Serial Number.
- Model Number.
- Capacity (tonnage).
- Entering and leaving water temperature.
- Flow rate (GPM).
- Unit Power Supply: Volts / PH / Amps; MCA / MOCP
- Refrigerant type.
- Sales Order #.
- Date of unit manufactured.

2.3 SPECIAL PROJECT REQUIREMENTS

A. Manufacturer shall provide to the owner diagnostic software and associated licensing for 5 users. Software and licensing shall be valid for no less than 5 years from substantial completion.

2.4 COMPRESSORS

A. Rotary Screw Compressor:

1. Semi-hermetic rotary screw compressor with capacity control slide valve, rolling element bearings and differential refrigerant pressure oil pump and oil heater.

2. Direct drive, constant speed, suction gas-cooled, semi- hermetic motor.

3. Crankcase heater shall energize when compressor is not running.

4. Refrigerant used shall be **R-513A**.

5. Each compressor shall have an isolated refrigerant circuit piped such that burnout of one compressor shall not damage the other compressor(s). Compressors shall not be piped in parallel arrangement into one refrigerant circuit.

B. Lube oil system shall include filtration devices with proper valves for removal of filter without removal of refrigerant charge.

C. Ultra Low Sound Compressor Control: Chiller manufacturer shall provide the following attenuation package and meet scheduled maximum A-weighted sound pressure level rating of 70dBA at 30' from the condenser coil side of chiller per AHRI. Complete sound attenuation package shall be provided regardless of if scheduled dBA is met without.

1. Acceptable sound attenuation package manufacturer: BRD-Noise and Vibration Control Inc. (Factory attenuation packages only are not acceptable)

2. Complete Ultra-low sound package shall be manufactured by BRD – Noise and Vibration Control, Inc., Hushcore™ Product line, no exceptions.

Contact: Kristopher Gonzalez – (610) 881-4490

3. Provide ultra-low sound blanket on a minimum of 100% coverage of each compressor, suction line, discharge line and oil separator: no exceptions.

4. Removable Sound Covers shall be constructed with a Silicone-fiberglass cloth outer jacket, a loaded vinyl barrier septum, fiberglass needle mat (11 lbs./ft.^{3} density), and a Silicone-fiberglass cloth inner jacket. The covers shall be connected together by means of a cloth straps with "D" rings and Velcro™ fasteners. The inner and outer jackets shall protect against UV rays, oil, and water. Finished Surface Mass – 3 lbs. per sq. ft., to cover compressors and extended components for the specified chiller. Stainless steel wire tie fastening assemblies are not acceptable.

5. Provide detailed ultra-low sound acoustical data with submittal, no exceptions. Data shall include sound pressure rating across each octave band and A-weighted average for chiller as built with attenuation package.

2.5 EVAPORATOR VESSEL

A. Shell and tube type, seamless or welded steel construction with cast iron or fabricated steel, heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets. Furnish multiple refrigerant circuits on multiple compressor units. Include a minimum of two (2) circuits.

B. Design, test, and stamp refrigerant side for 220 psig working pressure and water side for 300 psig working pressure, in accordance with ASME Section VIII.

C. Furnish water boxes, with tapped drain and vent connections with flanged or mechanical joint connections arranged to permit inspection of tubes from either end without disturbing refrigerant.

D. Furnish refrigerant chambers with baffles to distribute entering liquid and separate liquid from leaving gas.

EQUIPMENT SHALL BID AS AN ALTERNATE

E. Insulate with 0.75-inch minimum thick, closed cell foam, vapor barrier insulation with a maximum K factor of 0.26. This insulation shall have a 3mm thick PE embossed film to provide additional damage resistance as well as be UV resistant. Provide electric resistance immersion heater with thermostat to protect evaporator from freezing down to -20º F. ambient. This heater shall be field powered separate from main unit power by the 120V control circuit connection.

F. Furnish water drain connection and thermometer wells for temperature controller and low temperature cutout.

2.6 CONDENSER COILS, FANS AND MOTORS

A. **Alternate Bid Coils**: Coils shall be microchannel and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a corrosion resistant coating. Tubes shall be cleaned, dehydrated, and sealed. 3. Assembled condenser coils shall be pressure tested at the coil factory at 660 psig and subsequently shall be leak tested at 145 psig ±5 psig and pressure tested at 350 psig at final unit assembly.

B. **Alternate Bid Coils**: Aluminum Fins mechanically bonded to seamless copper tubing. Furnish sub-cooling circuits as applicable. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen or refrigerant.

C. If microchannel condenser coils are utilized the coils shall be provided with factory e-coating.

1. E-coated aluminum microchannel coil shall have a flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers. The coating process shall ensure complete coil encapsulation, including all exposed fin edges. E-coat shall have a thickness of 0.8 to 1.2 mil with topcoat having a uniform dry film thickness from 1.0 to 2.0 mil on all external coil surface areas including fin edges. E-coated coils shall have superior hardness characteristics of 2H per ASTM D3363-00 and cross hatch adhesion of 4B-5B per ASTM D3359-02. Impact resistance shall be up to 160 in./lb. (ASTM D2794-93). E-coated coil shall have superior impact resistance with no cracking, chipping, or peeling per NSF/ANSI 51-2002 Method 10.2. E-coated aluminum microchannel coils shall be capable of withstanding an 8000-hour salt spray test in accordance with the ASTM (American Society for Testing and Materials) (U.S.A.) B-117 Standard.

D. Louvered/Wire Panels: Factory installed louvered panels on external condenser coil faces, painted to match unit panels. Factory louvered panels around the base and ends of the machine to restrict unauthorized access.

E. Low Sound Fans: Reduced rpm, vertical direct driven propeller type condenser fans with fan guard on discharge. Fans shall have a minimum of 7 polymer blades with baffling. Metal blade fans are not acceptable.

F. Fan Motors: High efficiency 8-pole low RPM motor, direct drive fan connection, 3 phase power, insulation class “F”, current protected, Totally Enclosed Air-Over (TEAO) with double sealed, permanently lubricated ball bearings.

EQUIPMENT SHALL BID AS AN ALTERNATE

2.7 SOUND RATINGS

A. Noise Rating: Emitted A-Weighted Sound Pressure Level shall not exceed scheduled dBA at 30 feet from sides of the unit when measured according to ARI STANDARD 575.

B. Acoustic sound compressor blankets and Low Sound Fans shall be provided regardless of if scheduled dBA is met without.

2.8 REFRIGERANT CIRCUIT

A. Dual refrigerant circuits with one compressor per circuit.

B. Furnish for each refrigerant circuit:

1. Liquid line solenoid valve.
2. Filter dryer (replaceable core type without refrigerant loss or removal).
3. Liquid line sight glass and moisture indicator.
4. Electronic expansion valve.
5. Charging valve.
6. Insulated suction line.
7. Discharge line check valve.
8. Compressor discharge service valve.
9. Pressure relief device.
10. Oil separator.

2.9 CONTROLS

A. Factory mounted watertight steel control cabinet containing contactors, power and control wiring with factory wired single point power connection and non-fused disconnect switch with handle extending through face of cabinet. Control cabinet shall include microprocessor-based control system. System shall provide control of chiller operation and monitoring of chiller sensors, actuators, relays, and switches. Control panel shall include LCD display with keypad interface. Display messages shall be plain English. A coded two- or three-character display is unacceptable.

B. Control Panel shall be NEC409 and UL508A compliant (high short circuit current rating).

C. Chiller manufacturer shall provide a BACnet interface card (gateway) in control panel. Mounting, wiring, programming, and calibration of gateway shall be provided by chiller manufacturer. Chiller supplier shall provide BAS contractor with point list and programming information as needed.

1. A BACnet communication network interface card with building automation system shall enable building automation system operator to remotely control and monitor the chiller from an operator workstation. Control features available, and monitoring points displayed, locally at chiller control panel shall be available through building automation system.

D. Gateway shall include the following communication ports: One Ethernet port, one serial port configurable for EIA-232 or EIA-485 and one EIA-485 serial port.

E. Gateways that transfer data in proprietary language are not acceptable.

EQUIPMENT SHALL BID AS AN ALTERNATE

F. Gateway shall support open protocol communication for data sharing, alarm and event management, scheduling, trending and device and network management.

G. Furnish the following safety control with indicating lights arranged so machine is shut down and requires manual reset.

1. High condenser refrigerant pressure.
2. Low oil pressure.
3. High oil temperature.
4. High motor current.
5. High motor temperature.
6. Low refrigerant (evaporator) pressure.
7. High bearing temperature.

H. Furnish the following safety controls. Operating any one control shuts down machine:

1. Low chilled water temperature.

2. Chilled Water Integral flow switches within chiller. Flow proving switches shall be thermal dispersion type (IFM U 40100 or approved equal). Switches shall be U.L. listed, SPDT snap-acting, and pilot duty rated (125 VA minimum). Flow switch shall have relay output, wire break output and temperature output. Flow switch shall be redundant; control contractor to provide flow switch within piping.

3. Loss of an electrical phase.

I. Furnish manual machine off-auto switch on control panel and the following manual or menu driven software display.

1. Oil pump switch.
2. Machine selector switch to allow hand, off, or automatic operation.
3. Manual Set Point Adjustments:

    a. Leaving chilled water temperature.
    b. Current demand limit.

4. Status display:

    a. Chilled water flow proven.
    b. Cooling required.

        1. Unit running.
        2. Unit loading.
        3. Unit unloading.
        4. Manual reset required.
        5. Remote chilled water set point active.
        6. Remote current water set point active.

5. Set point and Temperature Display:

    a. Chilled water set point.
    b. Current limit set point.
    c. Entering evaporator water temperature.
    d. Leaving evaporator water temperature.

EQUIPMENT SHALL BID AS AN ALTERNATE

e. Entering condenser water temperature.
f. Leaving condenser water temperature.

6. Dial or Electronic Type Pressure Indicators.

a. Evaporator refrigerant pressure.
b. Condenser refrigerant pressure.
c. Low oil pressure (oil sump).
d. High oil pressure (oil supply).

J. Furnish the following operating controls:

1. Multi-step chilled water temperature controller to cycle compressor and activate capacity controls, with remote thermostat.

2. Five minute off timer prevents compressor from short cycling.

3. Periodic pump-out-timer to pump down on chilled water flow and high evaporator refrigerant pressure.

4. Provide low ambient control and high ambient options as required to ensure unit is capable of operation from 0°F to 115°F ambient.

5. Thermostat to cycle fan motors in response to outdoor ambient temperature.

6. Head pressure switch to cycle fan motors in response to refrigerant condensing pressure.

7. VFD control to vary speed of one at least one condenser fan motor in response to refrigerant condensing pressure.

8. Load limit thermostat to limit compressor loading on high return water temperature.

9. Three phase monitor to protect unit by stopping compressor on phase loss, phase reversal, phase unbalance, or under voltage.

10. Provide capacity control system capable of reducing unit capacity to 10% of full load. Compressor shall start in unloaded condition. Application of factory installed hot gas bypass on screw compressors shall be acceptable as required to meet specified minimum load. For scroll compressors, hot gas bypass must be provided and sized for minimum compressor loading on one circuit only. No exceptions.

11. Cycle counter and operating hour meter.

2.10 FACTORY MOUNTED VARIABLE FREQUENCY DRIVE (REQUIRED)

A. VFDs for each compressor shall have a DC link reactor.

B. All VFDs on the chiller (compressor motors and fans) shall be fully air-cooled and shall not require an additional glycol cooling system. If supplying a VFD glycol cooling system, the following must be provided in conjunction with and for the duration of the service/maintenance agreement specified in section 23 64 27 – 1.12.

EQUIPMENT SHALL BID AS AN ALTERNATE

1. Glycol solution replacement every 5 years.
2. Annual pH test.
3. Annual fluid level check.
4. Annual glycol condenser cleaning.

2.11 CHILLER PERFORMANCE

A. Minimum efficiency shall be per current local adopted IECC Supplement Table.

2.12 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Coordinate voltage with electrical drawings, ensure Overcurrent protective device size and type, and minimum circuit capacity are provided per unit manufacturer's published data.

B. Factory mounted non-fused molded case disconnect switch.

C. Single point power connection and grounding lug.

D. Provide integral 120V control power transformer.

E. Provide all 120V accessory branch circuits indicated on unit manufacturer's wiring diagram, including separate connection for oil heaters.

F. Power Factor:

1. Provide equipment with factory installed power factor correction capacitors as required to maintain a power factor of 95% at all load conditions.

2.13 FACTORY EDDY CURRENT TEST - REQUIRED

A. Prior to shipment to the jobsite the chiller manufacturer shall provide the necessary special test equipment and services of a factory trained technician to conduct an eddy current test of the evaporator tubes within the factory; field eddy current testing will not be acceptable. Submit final report to Owner and Engineer.

B. Four (4) copies of the eddy current test and their results shall be submitted to the Owner and Engineer for record keeping.

2.14 FACTORY CAPACITY TEST

A. The chiller manufacturer shall provide the necessary special test equipment and services of a factory trained technician to conduct various capacity tests prior to delivery to the project. Tests shall verify and certify that project equipment is in compliance with the Contract Documents.

B. Tests shall be conducted in accordance with AHRI Standard 550/590. The five (5) percent capacity allowance specified in the AHRI test standard shall not be applied.

C. Four (4) copies of the tests and their results shall be submitted to the Engineer for approval within five (5) calendar days from chiller test date. If test results do not demonstrate compliance with the Contract Documents, the project chillers will be tested with required correction procedures until compliance can be certified.

EQUIPMENT SHALL BID AS AN ALTERNATE

D. Conform to UL 1995 code for construction of chillers and furnish UL label.

E. Conform to ASME Section VIII for construction and testing of chillers.

2.15 PUMPOUT SYSTEM-IF REQUIRED

A. Provide service valves and connections for refrigerant pump-out to remote storage tank using portable condensing unit. Valves are not required if chiller is capable of pumping the entire refrigerant charge into condenser vessel for storage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install chiller on concrete housekeeping pad minimum four (4) inches high and six (6) inches wider than chiller base on each side. Refer to Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment.

B. Install units on vibration isolation. Refer to Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Install chiller accessories furnished loose for field mounting.

E. Install electrical devices furnished loose for field mounting.

F. Install control wiring between chiller control panel and field mounted control devices.

G. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit. Refer to Division 26, Electrical.

H. Provide the following piping accessories on evaporator chilled water piping connections.

3.2 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems.

B. Comply with requirements for piping specified in Section 23 21 13 "Hydronic Piping" and Section 23 23 00 "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to chiller to allow service and maintenance. Piping shall be arranged for easy dismantling to permit tube cleaning. Locate shut-off valves to permit removal of piping for access.

D. Evaporator Fluid Connections: Connect to evaporator inlet with nipple and flow switch, shutoff valve, Y-strainer, flexible connector, thermometer well for temperature controller, thermometer well and thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with flow switch with DDC interface, shutoff valve, balancing valve, flexible connector, thermometer well and thermometer, thermometer well for temperature controller, plugged tee with shutoff valve and pressure gage, and drain connection with

valve. Make connections to chiller with a mechanical coupling manufactured by Victaulic. Refer to Sections 23 05 19 Meters and Gages for HVAC Piping and 23 21 13 Hydronic Piping.

E. Provide control wiring between chiller control panel and field mounted control devices.

F. Provide connection to electrical service.

3.3 STARTUP SERVICE

A. A factory direct authorized service representative shall perform startup service. Chiller startup shall not be performed by contractor.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify that refrigerant charge is sufficient, and chiller has been leak tested.

3. Verify that pumps are installed and functional.

4. Verify that thermometers and gages are installed.

5. Operate chiller for run-in period.

6. Check bearing lubrication and oil levels.

7. Verify that refrigerant pressure relief device is vented outside.

8. Verify proper motor rotation.

9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.

10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.

11. Verify and record performance of chiller protection devices.

12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.

C. Prepare test and inspection startup reports.

3.4 FIELD QUALITY CONTROL

A. Furnish cooling season start-up, winter season shutdown service, for first year of operation. When initial start-up and testing takes place in winter and machines are to remain inoperative, repeat start-up and testing operation at beginning of first cooling season.

EQUIPMENT SHALL BID AS AN ALTERNATE

3.5 MANUFACTURER'S FIELD SERVICES

A. Manufacturer's representative shall certify in writing that installation is in compliance with manufacturer's recommendations.

B. Furnish services of factory trained representative for minimum three (3) days to leak test, refrigerant pressure test, and start-up, calibrate controls, and instruct Owner on operation and maintenance.

C. Oil Test: An oil sample shall be taken at start-up from each compressor. Sample will be used as a reference for all warranty oil tests. Oil samples shall be taken annually. The samples shall be tested using the Karl Fisher test method. If test indicates moister in oil, Contractor shall obtain factory recommended procedure to fix problem. Procedure shall be submitted to Engineer prior to any work being done. All labor and materials for corrective work shall be covered by manufacturer. Oil test shall be analyzed, and report submitted to engineer within 30 days of sample date. Oil samples shall be tasted by Analysts Services, Inc., or manufacturer provided testing services.

3.5 DEMONSTRATION AND TRAINING

A. Demonstrate system operations and verify specified performance. A functional test of the installed chiller control system shall be performed to demonstrate proper functioning of all interlocks and protective systems specified or otherwise required. This testing shall be conducted in the presence of the Owner's representative and the Engineer. The Contractor shall submit test procedure for approval by the Engineer prior to testing.

B. Coordinate testing with Testing and Balancing Contractor.

3.6 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean chiller externally and internally to remove foreign material and construction dirt and dust. Clean condensing coils, condensing fans, frame, etc.

B. **Prior to building occupation, contractor shall clean condenser coils free from dirt and debris.**

END OF SECTION

EQUIPMENT SHALL BID AS AN ALTERNATE

SECTION 23 73 13 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes modular factory fabricated air-handling units and accessories.
B. Related Sections:

1. Section 23 05 00 - Common Work Results for HVAC.

2. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

3. Section 23 07 16 - HVAC Equipment Insulation: Product requirements for insulation for placement by this section.

4. Section 23 33 00 - Air Duct Accessories: Product requirements for flexible duct connections for placement by this section.

5. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors for placement by this section.

6. Section 23 05 14 - Variable Frequency Controllers.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Provide line-by-line schedule notes review annotated to certify compliance or deviation.

C. Provide Footprint Square Footage Discrepancy Chart in spreadsheet form. Clearly show the differences in height, length, and width between the submitted units and designed units per plans for each AHU with corresponding tag.

D. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

E. Product Data, Submit the following:

1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.

2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.

EQUIPMENT SHALL BID AS AN ALTERNATE

3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.

4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity per ARI 260.

5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.

F. Manufacturer's Installation Instructions: Submit.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

EQUIPMENT SHALL BID AS AN ALTERNATE

A. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

B. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

C. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

D. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

E. Protect units from physical damage. Leave factory covers in place until startup of machine.

1.8 WARRANTY

A. Furnish one (1) year manufacturer parts and labor warranty for air handling units. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start up is not acceptable.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Spare materials shall be provided by equipment manufacturer and not by the installing mechanical contractor or "by others".

1. Filters: Furnish three (3) sets for each unit. One set during construction, a new set of filters for Test and Balancing services, and final new set at substantial completion. Filters shall be protected with polyester fabric at all times during construction.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

EQUIPMENT SHALL BID AS AN ALTERNATE

PART 2 - PRODUCTS

2.1 MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

A. Manufacturers: Subject to compliance with scheduled efficiencies, capacities, and specification, provide products by the following manufacturers.

1. **Refer to Specification 01 23 00 Alternates for acceptable manufacturers.**

2. **All materials and labor costs to coordinate, receive, install and start-up the equipment per this specification for a complete and operational system shall be included in the Contractor's Base Bid.**

B. All air handling units shall be of the same manufacturer and same model; mismatched manufacturer's will not be acceptable.

C. Configuration: Coordinate with project plans and schedules.

D. Performance Base: Sea level pressure or altitude.

E. Fabrication: Conform to AMCA 99 and ARI 430. Units shall be factory assembled and ship in one piece where possible. Shipping splits are acceptable provided manufacturer includes gaskets and bolts.

2.2 SPECIAL PROJECT REQUIREMENTS: CONSTRUCTION

A. In order to demonstrate energy compliance with 2015 IECC performance method; the project as specified and scheduled was energy modeled and complies. Alternate manufacturers are allowed but must not exceed maximum scheduled brake horsepower, efficiency, etc.

B. Air handling units shall be constructed to fit scheduled maximum dimensions including factory built mixing boxes and must maintain minimum specified access sections as scheduled and shown on plans. Rotating units to different orientations other than what is drawn on plans will be unacceptable. If potentially submitted equipment shall exceed any scheduled dimension, manufacturer shall provide performance data and dimensional data for consulting engineer to review and determine if proposed unit will fit within allotted space and maintain all required maintenance clearance. Equipment with deviations to dimensions shall be submitted 10 days prior to bid date for review.

C. Outside air / return air mixing boxes shall be factory fabricated with the same construction as the unit casing. Field supplied or installed mixing boxes are not acceptable. Dampers shall be factory installed on mixing box openings. Actuators shall be provided by the control's contractor. This applies to all the air handling units with energy recovery wheel and any unit with outside and return air ducted to the plenum.

2.3 UNIT IDENTIFACTION REQUIREMENTS

A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:

- Project name and address.
- Unit identification as indicated within Contract Documents.

EQUIPMENT SHALL BID AS AN ALTERNATE

- Serial Number.
- Model Number.
- CFM.
- Entering and leaving air temperature (DB/WB) (cooling and heating coil).
- Entering and leaving water temperature (cooling and heating coil).
- Cooling and heating coil flow rate (GPM).
- Fan Motor Horsepower.
- Blower est. ext. sp. (in. wg.).
- Unit Power Supply: Volts / PH / Amps; MCA / MOCP
- Sales Order #.
- Date of unit manufactured.

B. Custom label shall be provided by and installed at the factory. Label shall not be by a third party or contractor.

2.4 CASING

A. Base rail shall be a minimum of 14-gauge or heavier G-90 galvanized steel and shall be a minimum of six (6) inches in height. Base assembly shall be thermally broken and insulated with a minimum of 2" thick, R-13 closed-cell sprayed foam. Assemble multiple sections that are shipped loose with gaskets, caulk, and bolts per the manufacturer's installation instructions.

B. External Casing:

1. Galvanized Steel: 18-gauge G90 with expanded foam injected insulation.

C. Internal Casing:

1. Galvanized Steel: Solid 20-gauge G90. Provide 20-gauge perforated panels in fan section and discharge plenum.

D. Casing shall be supported by free-standing 16-gauge G90 structural frame with removable panels. Framing members shall have thermal break and injected with expanded foam insulation. Structural integrity of frame shall not be affected by removing panels. Top, bottom, and side panels shall be of one-piece double-wall construction, formed and reinforced to provide a rigid assembly. All panels shall be completely gasketed at factory with a minimum 1/4-inch-thick x 3/4 inch wide closed-cell neoprene. Top and side panels shall be easily removable for service.

E. Insulation: Expanded Foam.

1. 'K' (Ksi) factor at 75 degrees Fahrenheit: Maximum 0.154 Btuh inch / sq. ft. / degrees Fahrenheit.

2. Density: Two (2) inch thick, minimum 1-1/2 lbs. /cu ft. throughout the entire unit. One (1) inch thick casing panels in any section is unacceptable.

3. Insulation in perforated sections shall be coated on air side to prevent erosion into air stream. Uncoated insulation is unacceptable.

4. If air unit structural frame comes into contact with conditioned air, it shall be insulated with the same material throughout the rest of the unit.

EQUIPMENT SHALL BID AS AN ALTERNATE

F. Access Section: Minimum 24” access section with minimum 19” door clearance of double wall galvanized steel construction for flush mounting, with gasket, latch, and handle assembly, same thickness as casing. Access door frame shall be extruded aluminum; foam filled with a thermal break barrier and include a full perimeter gasket. All access doors shall match unit casing construction, include a thermal break. Provide access section between parallel coil sections, upstream of coil sections, upstream and downstream of the energy recovery wheels, in fan sections, filter sections, and mixing boxes.

G. Cooling Coil Drain Pan: Welded double wall, type 304 stainless steel IAQ pan with two (2) inch insulation and welded corners. Drain pans without welded corners are not acceptable. Cross break and pitch to drain connection. Cooling coils with a finned height greater than 48 inches shall have an intermediate stainless steel IAQ drain pan extending entire length of coil. Intermediate pan shall have a minimum of two drop tubes to main pan. Drain pans shall allow no standing water and comply with ASHRAE Standard 62. Drain pans must be accessible for cleaning.

H. Strength: Furnish structure to brace casings for suction pressure of five (5) inch wg, with maximum deflection of 1 in 200. Casing deflection shall not exceed a L/240 ratio when subject to an internal pressure of +/- 8-in wg and shall exhibit no permanent deformation at +/- 9-in wg. L is defined as the longest linear panel or cabinet length (measured to AHRI 1350 Cd Level 2).

2.5 FANS

A. Type: Refer to Air Handling Unit Schedule for fan type and drive type.

1. Supply Fans:

a. Direct drive plenum fans shall be single width single inlet type with backward inclined airfoil blades. Plenum fan wheel, airfoil blades and hub shall be constructed from aluminum.

2. Exhaust Fans (associated with energy recovery wheel section):

a. Direct drive plenum fans shall be single width single inlet type with backward inclined airfoil blades. Plenum fan wheel, airfoil blades and hub shall be constructed from aluminum

B. Fan shall be statically and dynamically balanced at the factory as a complete fan assembly.

C. The Fan wheels shall be keyed to shaft to prevent slipping.

D. Construction: AMCA Class II minimum.

E. Performance Ratings: Conform to AMCA 210 and label with AMCA Certified Rating Seal.

F. Sound Ratings: Tested to ARI 260 and label with Certified Sound Rating Seal.

G. Bearings: Provide permanently lubricated bearings.

EQUIPMENT SHALL BID AS AN ALTERNATE

H. Mounting: Locate fan and motor internally on welded or bolted steel base coated with corrosion resistant paint or rust-resistant G90 steel and factory-mounted motor on slide rails. Furnish access to motor, drive, and bearings through hinged access doors. Mount base on vibration isolators with 2” deflection.

I. Fan Modulation: Variable frequency drive.

J. Fan Motors: All motors shall be premium efficiency, NEMA MG-1Section 3, Inverter Duty. Refer to Specification 23 05 13 - Common Motor Requirements for HVAC Equipment for acceptable motor manufacturers.

K. Flexible Connection: Provide internal flexible connection between fan and air unit casing. Flexible connection between air unit casing and connecting duct shall not be provided when fan is internally isolated with flexible connection to casing.

2.6 BEARINGS AND DRIVES

A. Bearings:

1. Plenum fans shall have. Heavy duty pillow block style, self-aligning, regreasable roller type bearings selected for a minimum average life (L50) of 500,000 hours.

B. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated to prevent corrosion.

C. Motor Shaft Grounding Kit: For all AHU motors, a motor shaft grounding kit shall be provided. This shall be factory installed prior to shipment. If not available from the factory, the manufacturer is responsible for providing kits and field installation with no additional cost to owner or contractor.

D. Motor: Motor shall be non-overloading. Motor horsepower shall be sized at a point on fan curve resulting from 105 percent of design RPM at scheduled CFM with a reduction in static pressure of 0.5-inch wg. All fan motors shall be in accordance with Section 23 05 13 - Common Motor Requirements for HVAC Equipment

1. Motor Enclosure: Totally Enclosed Fan-Cooled (TEFC); ECM motors shall not be acceptable.

2. Provide (2) two forged motor lifting eyes and oversized conduit boxes with ground lugs.

3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

4. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified

2.7 COILS

A. Provide access doors upstream and downstream of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank-offs and casing sealing grommets at connection penetrations. Coils shall

be supported by stainless steel coil support members maintaining a minimum of 1" separation between bottom of coil casing and drain pan.

B. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

C. Water Heating Coils:

1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.

2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

3. 18-inch access section between parallel coil faces.

4. Casing: Die formed channel frame of galvanized steel.

5. Tubes: 5/8-inch OD seamless copper, 0.020" thick, expanded into fins, brazed joints or 1/2-inch OD seamless copper, 0.025" thick, expanded into fins, brazed joints.

6. Fins: Aluminum, maximum of 11 fins per inch. Minimum fin thickness shall be 0.006" aluminum.

7. Coil supports shall be 12-gauge type galvanized steel.

D. Water Cooling Coils:

1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.

2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

3. Coils shall be a maximum of ten (10) rows deep.

4. 18-inch access section between parallel coil faces.

5. Casing: Die formed channel frame of 16-gauge type 304 stainless steel.

6. Drain Pans: Extend 12 inches downstream of coil and for coil banks more than 48 inches high provide intermediate pan with down spouts.

7. Tubes: 5/8-inch OD seamless copper, 0.020" thick, expanded into fins, brazed joints or 1/2-inch OD seamless copper, 0.025" thick, expanded into fins, brazed joints.

8. Fins: Aluminum, maximum of 11 fins per inch. Minimum fin thickness shall be 0.006" aluminum.

9. Coil supports shall be 16-gauge type 304 stainless steel.

EQUIPMENT SHALL BID AS AN ALTERNATE

E. DX Cooling Coils:

1. Headers: Seamless copper tube with brazed joints.

2. Coils shall be a maximum of eight (8) rows deep.

3. 18-inch access section between parallel coil faces.

4. Casing: Die formed channel frame of 16-gauge type 304 stainless steel.

5. Drain Pans: Extend 12 inches downstream of coil and for coil banks more than 48 inches high provide intermediate pan with down spouts.

6. Tubes: 5/8-inch OD seamless copper, 0.020” thick, expanded into fins, brazed joints or 1/2-inch OD seamless copper, 0.025” thick, expanded into fins, brazed joints.

7. Fins: Aluminum, maximum of 11 fins per inch. Minimum fin thickness shall be 0.006” aluminum.

8. Coil supports shall be 16-gauge type 304 stainless steel.

F. Tube Velocities: Coil tube design velocity shall be between 2 feet and 5 feet per second and also maintain design water side temperature difference down to 30 percent flow through coil. Provide tubes that are enhanced internally if minimum initial design tube velocity cannot be obtained.

2.8 TOTAL ENERGY RECOVERY WHEEL UNIT

A. Manufacturers: Subject to compliance with scheduled efficiencies, capacities, and specification, provide products by the following manufacturers.

1. SEMCO
2. Innergytech

B. Provide energy recovery wheel where scheduled.

C. Casing construction shall be the same as the rest of the unit.

D. Total energy recovery wheel shall be installed by air unit manufacturer at the factory prior to shipment and shall be an integral component of the fully assembled unit. Loose or separate wheel sections shall not be acceptable.

E. Energy recovery wheel shall be constructed of corrugated media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated bonded or synthesized onto the media are not acceptable due to delaminating or erosion of the desiccant material.

F. Media shall be resistant to corrosion resistance and resistance against attack from laboratory chemicals present in pharmaceutical, hospital, etc. environments as well as attack from external outdoor air conditions. Face flatness of the wheel shall be maximized in order to minimize wear on inner seal surfaces and to minimize cross leakage.

G. Rotor shall be constructed of alternating layers of flat and corrugated media.

EQUIPMENT SHALL BID AS AN ALTERNATE

H. Wheel layers should be uniform in construction forming uniform aperture sizes for airflow. Wheel construction shall be fluted or formed honeycomb geometry so as to eliminate internal wheel bypass. Wheel layers that can be separated or spread apart by airflow are unacceptable due to the possibility of channeling and performance degradation.

I. The minimum acceptable performance shall be as specified in the unit schedule.

J. Desiccant Material: The desiccant material shall be a molecular sieve, and specifically 3A molecular sieve to minimize cross contamination.

K. Wheel Media Support System: The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub. The wheel construction should allow for post fabrication wheel alignment.

L. Wheel Seals: The wheel seals shall be full contact nylon brush seals or equivalent. Seals should be easily adjustable.

M. Wheel cassette: Cassettes shall be fabricated of heavy duty reinforced galvanized steel or welded structural box tubing. Cassettes shall have a built-in adjustable purge section minimizing cross contamination of supply air as shown on unit schedule.

N. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings, or alternatively, external flanged or pillow block bearings.

O. Drive systems shall consist of fractional horsepower AC drive motors with multi-link drive belts.

P. Face and bypass dampers shall be furnished as shown on unit schedule and drawings.

Q. The wheel shall be listed or recognized by UL or equivalent.

R. Energy Recovery Wheel shall be controlled via variable frequency drive (VFD). VFD shall support full economizer and frost protection modes. VFD shall be shipped loose for field installation by mechanical contractor and wired by electrical contractor. The VFD shall be wall mounted in a NEMA 1 enclosure, include an LCD display screen, and communicate to the BAS via BACnet MS/TP. BAS shall provide and install temperature sensors in all four airstreams. VFD serving wheel shall match the same VFD manufacturer for all other equipment (pumps, AHU's, Cooling Tower motors, etc.).

2.9 GERMICIDAL UVC EMITTERS (FUTURE INSTALLATION)

Provide adequate space in the cooling coil section to allow for UVC Emitter installation and wiring and allow for a minimum 18" access door. Maintain full service; UVC Emitters to be provided in future.

A. UVC Emitters shall be provided for each Air Handling Unit and manufactured by Steril-Aire, Inc. only. UVC lights, including but not limited to safety switches and non-fused service disconnects, shall be field installed by local Steril-Aire factory authorized representative and not by mechanical contractor. A separate 120v/1ph electrical connection shall be provided by the electrical contractor.

B. Provide UVC Emitter in the same section as cooling coil immediately downstream of cooling coils and over drain pans; lights shall provide full coverage of cooling coils and

drain pan. The UVC emitter shall be mounted inside the air handler casing a minimum of 12” downstream of cooling coil.

C. UVC Emitter and fixture shall be factory assembled and tested. Unit shall consist of housing, power source, reflector, emitter sockets, emitter, door safety switches and unit mounted disconnect for separate 120v / 1ph / 60 Hz power supply. Unit shall be constructed to withstand HVAC environments and shall be UL and CSA listed for damp locations.

Housing shall be constructed of hospital grade stainless steel and equipped with ½”conduit openings on each end to facilitate conduit nipple coupling fixture to fixture and wiring to power. Incorporate all components into one integral assembly that maximizes serviceability. Unit shall be designed to be mounted inside the air stream and downstream of the cooling coil.

The power source shall be a Class P2, rapid start type with a power factor of 0.99 and an efficiency of not less than 89%. Unit voltage shall be 120 and designed to maximize photon production, radiance, and reliability in cold or moving air streams of 35°-170°F. 100% RD and at any velocity and shall include RF and EMI suppression and Smart System – “End of Lamp Life” protection.

Reflector shall be constructed of heavy gauge aluminum alloy with a minimum 86% reflectance at 254 nm.

Sockets shall be medium bi-pin, double click safety, and twist lock type. They are constructed of a UVC resistant polycarbonate.

Emitter tube shall be high output, hot cathode, T5 diameter, medium bi-pin type that produces broadband UVC of 250 – 260 nm. Each tube shall produce the specified output at any airflow velocity and air temperature of 35°-170°F and produce no ozone or other secondary contamination.

Independent testing: When tested in accordance with the general provisions of IES Lighting Handbook, 1981 Application volume, output per 1” arc length is not less than 10μW/cm² at 1 meter in a 400-fpm airstream of 45° F.

2.10 AIR FILTRATION

A. Filter Box: Section with filter guides, access doors as shown on plans, for side loading with gaskets and blank-off plates.

B. Filter Frames: Pad holding frames shall be permanent metal frames designed to contain replaceable filter media pads. Frames shall be constructed of 22-gauge, galvanized steel U channel cell sides, expanded metal support grid, 9-gauge hinged retainer gate, sized to fit in standard universal holding frames, and accept maximum 2” thick media. Acceptable manufacturers: AAF or pre-approved equal.

C. Replaceable Filter Media: MERV 11 or greater rating in accordance with ASHREA Test Standard 52.2-2007.

D. High-Capacity Angle Filter: Two (2) inch extended area filters. Air quantities as scheduled; clean pressure drop of 0.10 inches wg; dirty pressure drop of 0.75 inches wg.

E. Filter Area: Max velocity of 350 FPM.

EQUIPMENT SHALL BID AS AN ALTERNATE

F. Provide list of each air handling unit with associated filter sizes to owner at substantial completion.

2.11 CONTROLS

A. Controls: Refer to Section 23 09 23 - Direct-Digital Control System for HVAC.

2.12 CAPACITY

A. Performance: Provide equipment as scheduled on Drawings.

2.13 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Provide equipment with electrical characteristics as shown on Electrical Drawings.

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Requirements for motors.

C. Section 23 05 14 - Variable Frequency Controllers: Requirements for drives.

D. Combination Starter-Disconnect Switch: Provided by Division 26.

E. Junction Box: Factory provided, mounted, and wired junction boxes on each fan section. J-box shall allow electrical contractor to connect power to device without penetrating through cabinet. Field installed J-boxes will not be acceptable; it shall be the complete responsibility of the manufacturer to install. Units shall be shipped with J-boxes pre-wired and mounted. Within equipment submittal the manufacturer shall show J-box location on plan view dimensional drawing.

F. Motor Overload Panel: For units with more than one fan, and to allow for a connection to a single variable frequency drive, provide a factory mounted and wired motor overload panel. Panel shall be UL listed, NEMA 1 enclosure with IECC manual starters with rotary type operators and auxiliary contacts.

G. All starters shall be equipped with integral phase-failure relay (automatic resetting type) to shut down motor upon loss of an electrical phase.

2.14 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

D. Refrigerant Coils: Factory tested to 450 psig according to ARI 410 and ASHRAE 33.

EQUIPMENT SHALL BID AS AN ALTERNATE

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with ARI 430.

B. The mechanical rooms shall be kept broom clean prior to starting any mechanical equipment to minimize dust in the system.

C. Install assembled units with internal vibration isolators. Internally isolated fans shall be provided with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating. Refer to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Equipment Mounting: Install air-handling units on concrete bases using elastomeric pads. Secure units to anchor bolts installed in concrete bases. Comply with requirements for concrete bases; Comply with requirements for vibration isolation devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

E. Contractor to provide fixed sheaves required for final air balance as dictated by Test and Balance Contractor.

F. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

G. Insulate coil headers located outside airflow as specified for piping. Refer to Section 23 07 19 - HVAC Piping Insulation.

H. Provide trapped condensation drain line routed to the nearest floor drain. Refer to detail on Drawings and Section 23 21 13 - Hydronic Piping.

I. Installation of Hot Water Heating and/or Chilled Water Coil:

1. Make connections to coils with unions. Position unions to permit coil removal.

2. Connect water supply to leaving airside of coil (counter flow arrangement).

3. Locate water supply at bottom of supply header and return water connection at top.

4. Install water coils to allow draining and install drain connection at low points.

5. Install the following piping accessories on piping connections. Refer to Section 23 21 13 - Hydronic Piping.

a. On supply: (refer to coil connection details)

1) Thermometer well and thermometer.
2) Well for control system temperature sensor.
3) Shutoff valve.
4) Pressure gage.
5) Strainer

EQUIPMENT SHALL BID AS AN ALTERNATE

b. On return: (refer to coil connection details)

1) Air vent.
2) Thermometer well and thermometer.
3) Well for control system temperature sensor.
4) Pressure gage.
5) Modulating control valve (by BAS).
6) Victaulic / TA 78K (combination balancing / shut-off globe valve with memory stop and pressure / temperature ports).
7) Shutoff valve (provided by mechanical contractor in addition to balancing valve).

6. Install valves and piping specialties in accordance with details as indicated on Drawings.

7. Install manual air vents at high points complete with shutoff valve. Refer to Section 23 21 13 - Hydronic Piping.

8. Install floor support stands at piping drops to air unit coil connections. Air unit coil shall not carry any suspended piping load.

J. Air unit manufacturer representative shall remove vibration isolation shipping blocks prior to start-up and ensure that fan base is free floating, and isolators are not short-circuited during operation.

3.2 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

B. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to air-handling unit to allow service and maintenance.

D. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

E. Refrigerant Piping: Comply with applicable requirements in Section 23 23 00 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

F. Coordinate duct installations and specialty arrangements with schematics on Drawings and with requirements specified in Section 23 31 13 "Metal Ducts" and Section 23 33 00 "Air Duct Accessories."

G. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 23 33 00 "Air Duct Accessories."

EQUIPMENT SHALL BID AS AN ALTERNATE

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks.

2. Charge refrigerant coils with refrigerant and test for leaks.

3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify that shipping, blocking, and bracing are removed.

3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.

4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.

5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.

6. Verify that zone dampers fully open and close for each zone.

7. Verify that outdoor- and return-air mixing dampers open and close and maintain minimum outdoor-air setting.

8. Comb coil fins for parallel orientation.

9. Verify that proper thermal-overload protection is installed for electric coils.

10. Install new, clean filters.

EQUIPMENT SHALL BID AS AN ALTERNATE

11. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.6 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units externally and internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, comb coils, drain pans, and filter housings, and install new, clean filters.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

3.8 PROTECTION OF FINISHED WORK

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

B. All air units shall remain in manufacturer’s protective shipping wrap during construction. Air unit casing openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

END OF SECTION 23 73 13

SECTION 23 74 33 - PACKAGED, 100% OUTDOOR, HEATING AND COOLING KITCHEN HOOD MAKEUP-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes packaged heating and cooling units capable of supplying up to 100 percent outdoor air.

1. Integral Indirect Gas-fired heating.
2. Integral, temperature controls.
3. Roof curbs.

1.2 SEISMIC DESIGN

A. Should the project be located within a seismic zone requiring special provisions for support and restraint of equipment, components, and piping. Refer to state or local codes for Seismic, Wind, Flood Load Design for additional requirements.

1.3 WIND LOAD DESIGN

A. Refer to state or local codes for Seismic, Wind, Flood Load Design for additional requirements.

B. Miami Dade rated up to ±150psf per TAS 201, 202 & 203 paired with 20” curb or shorter.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each unit, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Provide line-by-line specification review annotated to certify compliance or deviation.

C. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.

3. Prepare the following by or under the supervision of a qualified professional engineer:

a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
b. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof-curb mounting details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs will be attached.
2. Roof openings
3. Roof curbs and flashing.

B. Required roof penetrations for ducts, pipes, and electrical raceways, including size and location of each penetration.

C. Startup service reports.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For units to include in emergency, operation, and maintenance manuals.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Spare materials shall be provided by equipment manufacturer and not by the installing mechanical contractor.

1. Filters: One (1) set for each unit.

1.8 QUALITY ASSURANCE

A. Entire unit shall be ETL Certified per ANSI Z83.4 or ANSI Z83.18 and bear an ETL mark.

B. Indirect gas-fired heaters shall be ETL Certified as a component of the unit.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 WARRANTY

A. The manufacturer shall provide a full machine parts and labor warranty for a period of one (1) year. **Warranty shall begin from date of Certificate of Substantial Completion** and not by shipment date. Provide a sample of manufacturer's warranty certificates as described below within equipment submittal. Warranty start dates from shipment or startup will not be accepted.

B. The manufacturer shall provide factory certificates for each Unit listing at a minimum the model, serial number, and warranty information as specified above. Payment to contractor may be held if warranty certificates are not provided in a timely manner.

C. All warranty work shall be performed by factory direct service technician. Warranty work shall not be performed by installing mechanical contractor.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Units shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting

installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

E. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

F. Protect units from physical damage. Leave factory covers in place until startup of machine.

PART 2 - PRODUCTS

2.1 GENERAL

A. Supply single zone one piece packaged units that are complete as per the following specification, deliver all capacities scheduled, and conform to design indicated herein. Alternate layouts or dimensional changes will not be accepted.

2.2 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide the following:

1. Captiveaire.

B. Configuration: Coordinate with project plans and schedules.

C. Performance Base: Sea level pressure or altitude.

D. Fabrication: Conform to AMCA 99 and ARI 430. Units shall be factory assembled and ship in one piece where possible. Shipping splits are acceptable provided manufacturer includes gaskets and bolts and performs final unit inspection.

2.3 CABINET

A. Cabinets shall be constructed of minimum 24-gauge. Sizes 2, 3, or 4 cabinets shall be 20-gauge G-90 galvanized steel riveted together via structural pop-rivets. All metal shall be CNC bent for precise assembly.

1. Rigging Provisions: The unit shall have a structural base constructed of minimum 18-gauge in cabinet size 1 and 14-gauge in cabinet sizes 2, 3 & 4 G-90 galvanized steel, and include full sized fork pockets and lifting points on all four sides.

2. Roof Construction: The lids shall be fabricated by forming a double-standing, self-locking seam that requires no additional support. Roof shall be pitched to allow for proper drainage.

3. Exterior Wall Construction: All exterior walls shall consist of a double wall, G-90 galvanized steel construction. Cabinet size 1 shall be insulated with 1-inch thick, R4.3 fiber glass duct board insulation. Cabinet sizes 2, 3 & 4 shall be insulated with 2-inch thick, R13 closed cell foam.

4. Service Access Doors: All door jambs shall be gasketed around their perimeter, and allow for doors to be mounted via removable, spring actuated, stainless steel hinges with stainless steel rivets, and self-compressing latches. Each compartment shall have removable access panels to allow for ease of service and maintainability. Electrical cabinet access doors shall have a door hold installed to prop doors open. All doors shall have stainless steel latches which are pad lockable. Electrical cabinet doors shall be outfitted with schematic/manual pouches formed into the door, along with wiring diagram attached to the indoor of the door from the factory.

B. Entire interior and exterior casing shall be constructed of minimum G90 galvanized steel. Unit shall have undergone a salt spray corrosion test as per ASTM B 117.

C. Entire unit shall be Miami-Dade wind rated up to ±150psf per TAS 201, 202 & 203 on any units utilizing a 20” or shorter factory provided roof curb.

D. **Unit shall be factory painted with enamel paint. Color: Tan Enamel coating.**

2.4 AIRFLOW CONFIGURATIONS

A. Discharge: Unit shall be configurable for Down (vertical) discharge through the unit's base.

B. Return: Unit shall also be configurable for No Return, down (vertical) Return through the unit’s base.

C. Intake Airflow: Unit configuration shall be through use of a fresh/outdoor and return air damper.

1. Damper: Shall exceed AMCA Class 1A standard for low leakage. Damper assembly shall be a single assembly and outfitted with an integral bird screen and louver/gutter system to divert any drainage through the base of the unit – intake air hood not required.

2. Actuator: A single direct drive damper actuator shall be used with spring return to ensure that the outdoor air section closes when not powered.

2.5 SUPPLY AIR BLOWER AND MOTOR

A. All supply fans shall be direct drive (belt-drive not acceptable) variable speed plenum fans.

B. Blower Motor: Motor shall be a premium efficiency motor available as:

1. Totally Enclosed Fan Cooled (TEFC) motor driven by a Variable Frequency Drive.

C. Fans to be selected at or near efficiency peak. (Submit fan curves).

D. Blower and motor assembly shall be dynamically balanced. The entire blower and motor assembly shall be mounted on rubber vibration isolators. Wheels balanced as per AMCA 204-96, Balance Quality and Vibration Levels for fans.

E. Unit equipped with total CFM monitoring to measure airflow across supply discharge.

2.6 REFRIGERATION SYSTEM

A. Unit shall utilize a variable speed inverter duty scroll compressor with the following features:

1. Modulation: Compressor shall be capable of compressor speed modulation from 15%-100% on 5, 6, 7.5, 8, 10, & 12.5 Ton units. Compressor shall be capable of compressor speed modulation from 25%-100% on 15, 20, 22, 25, 30, 40, and 50 Ton units.

2. Refrigerant: Unit shall be factory charged with **R-454B** refrigerant.

3. Vibration Isolation: Compressor as well as blower assembly shall each be mounted on rubber vibration isolators to reduce transmission of vibration to the building structure.

4. Internal Overload Protection: Compressor shall include internal thermal overload production to protect against excessive motor temperatures.

5. Crankcase Heater: Compressor shall include a crankcase heater to protect against liquid flood-back and elimination of oil foaming on startup. The crankcase heater must remain powered when the compressor is not in operation.

6. Oil Management: Unit shall utilize both passive and active oil return management using Oil Level Sensor and scheduled oil boosts.

7. Monitored Envelope: Unit shall monitor all critical refrigeration points to ensure compressor does not operate outside of safe operating envelope.

8. Throttling Logic: Unit shall allow for high head pressure monitoring throttle mode for high ambient operation, and low suction pressure throttle mode for low capacity operation or any conditions resulting in low suction pressure.

9. Pump-Down: Active pump-down mode with discharge line check valve to protect against liquid migration into compressor during idle times.

B. The unit shall be outfitted with the following:

1. Indoor Coil: Indoor coil shall be a high efficiency 4-10 row coil design with aluminum fins mechanically bonded to copper tubes. Coil is staggered to increase turbulence, reduce the coil bypass factor, and ultimately increase the time the air stays within the coil. Includes two probe sensors to read average coil face temperature.

2. Electronic Expansion Valve: Each refrigeration circuit will be outfitted with an electronic expansion valve metering device which can be throttled from 0-100% open to allow for precise superheat control.

3. Indoor Coil Drain Pan: The indoor coil shall be outfitted with a sloped stainless steel drain pan. This pan shall be insulated along the entire base to prevent condensation and outfitted with a safety overflow switch which will automatically shut down cooling operation prior to water overflowing the drain pan in the event of a drain clog. The entire drain pan shall be 20 GA Stainless Steel construction and wrap beneath the entire coil with flashing on entering side of coil to ensure capture of all condensate. Drain pan discharge pipe shall also be stainless steel construction. Drain pan shall be pitched to exceed ASHRAE 62.1 standard.

4. Base of the condensing coil cabinet shall be pitched away from the unit as a safety to ensure all draining exits away from the curb.

5. Hot Gas Reheat Coil: The unit shall include a copper tube and aluminum fin hot gas reheat coil mounted downstream of the indoor coil. This coil shall be controlled via fully modulating hot gas reheat valve to provide precise reheat temperature control. This coil shall include the addition of an evaporative coil leaving condition sensor to maintain a coil dew point. This also prevents operation of a dehumidification call when intake dew point conditions are found to be below space dew point conditions, preventing wasted energy.

6. Outdoor (Condenser) Coil: Outdoor coil shall be a high efficiency coil design with aluminum fins mechanically bonded to copper tubes. The coil shall be downward sloped to protect coil from hail damage. Optional hail guards may also be outfitted to the outdoor coil for added protection from hail bouncing off the unit's roof up the coil.

7. Outdoor Fans: The outdoor coil shall have a vertical discharge outfitted with quiet, efficient, fully modulating Electronically Commutated Motor (ECM) condensing fans. These fans shall modulate to maintain a temperature differential between outside air and the outdoor coil.

C. To help mitigate any long-term potential for leaks or hardware failures, the unit shall be outfitted with the following protection measures:

1. Suction line accumulator for added protection against liquid entering suction line of compressor.

2. Bi-flow, low pressure drop, filter drier.

3. Electronic Expansion Valve (EEV) for precise superheat control. EEV shall open partially allowing system pressure equalization prior to activation of the compressor.

4. On optional heat pump units, use of a single 3-way reheat valve to prevent obstructions due to valve failure.

5. Protective rubber sleeves installed on all distribution lines of indoor coil to prevent wear from rubbing.

6. All refrigeration ports shall be short-stub assembly and any access port with a transducer or switch is mounted vertically to mitigate risk of bent/cracked stub joints.

7. Refrigeration circuit shall be mechanically CNC pre-bent tubing wherever possible with minimal brazed joints to minimize points for potential refrigeration leaks.

8. Factory tested for leaks via high pressure nitrogen decay and helium tracer gas testing.

9. Suction line temperature sensor failure detection.

10. Preventative failure alerts through a manufacturer provided, cloud based, cellular remote monitoring system.

11. A2L refrigerant leak detectors are paired with custom logic to mitigate the risk of fire in the event of a detected leak.

2.7 HEATING SYSTEM

A. The gas burner shall be an indirect-fired, push-through type, using natural gas or liquid propane gas. The inlet-supply pressure to the unit for natural gas must be 7” w.c. minimum. For liquid propane gas, the minimum must be 11" w.c.

B. Burner shall be a tubular in-shot fired design capable of using natural or LP type gas. Each burner ignition shall be of the direct-spark design with remote flame sensing at inlet of the last firing tube of the gas manifold.

C. Direct-sparking sequence shall last through the complete duration of the trial for ignition period for guaranteed light-off. Burner shall always be lit at maximum gas flow and combustion airflow for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal.

D. All furnaces shall be controlled by an electronic Vernier-type fully modulating control system capable of achieving 81% combustion efficiency over the entire gas firing range of the unit.

E. Each furnace shall have:

1. A minimum turndown ratio of 6:1 for natural gas and 5:1 for LP gas while maintaining a constant 81% efficiency (90% for high efficiency furnace option). No cold air bypass of the heat exchanger.

2. Each furnace heat exchanger shall be a bent-tube style design made entirely of stainless steel.

3. Stainless steel Quick Seal Connection for gas connection.

4. Manifold and Input gas pressure gauges.

5. Factory piped condensate drain to exterior of cabinet.

6. A combustion flue to be installed on adjacent side as combustion intake with integrated high velocity wind cap.

7. A blocked vent safety airflow switch with high temperature silicone tubing operating off of absolute pressure measured inside of the power-vent blower housing.

8. A high temperature auto-recycling limit with a maximum non-adjustable set point.

9. A manual reset high temperature flame roll out switch with a non-adjustable set point.

10. Each furnace compartment shall have a removable post and panel that allows the furnace to be easily removed for service and maintainability.

11. A power-vent assembly for exhausting flue gases with a PSC or ECM type motor that is securely mounted and easily accessible/removable for service.

12. A 0-10” w.c. gas pressure gauge installed on the gas manifold.

F. Each electric heater shall have:

1. SCR electric inserts for side or down discharge supply.

2. Electric coils are controlled using SCR controls. SCR is a time proportioning type controller that modulates the heater and supplies the exact amount of power to match the heat demand with a 10:1 turndown per stage with full modulation between minimum turndown and max output.

2.8 FILTERS

A. The filter rack shall be designed to handle a maximum 2” thick high efficiency MERV 13 replaceable filter. Filters replaceable through side access, hinged access door.

B. Replaceable Filter Media: As indicated above MERV 13 or greater rating in accordance with ASHRAE Test Standard 52.2.

C. High-Capacity Filter: Two (2) inch extended area filters. Air quantities as scheduled; clean pressure drop of 0.10 inches w.g; dirty pressure drop of 0.75 inches w.g.

D. Filter Area: Max velocity of 350 FPM.

E. Acceptable manufacturer: American Air Filter or prior approved equal.

2.9 ELECTRICAL

A. All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against risk of condensation.

B. Units shall be provided with single point electrical connection or separate electrical heat connection.

C. Unit shall be provided with a door safety switch that de-energizes the supply fan when the door is opened.

D. Unit shall be provided with a factory mounted averaging supply air temperature sensor to allow for accurate discharge temperature readings within unit when a downstream sensor is not installed. Field mounted and wired discharge air sensors will not be accepted.

E. Unit shall be provided with a factory mounted averaging intake air temperature sensor to allow for accurate intake temperature reading regardless of how the OA/RA dampers are positioned.

F. The electrical cabinet shall be outfitted with the following:

1. LED electrical cabinet service light with automatic activation upon door switch.

2. Color wiring schematics, laminated to the interior wall of the cabinet doors.

3. Factory mounted disconnect with unit bottom knockouts.

4. A LED backlit, LCD Human-Machine Interface (HMI) shall be mounted within the unit's control cabinet to allow for all set points configuration and refrigeration system monitoring at the unit.

5. Up to 4 additional space mounted HMIs available. Additional HMIs shall allow for full programming capabilities and are outfitted with integral temperature and humidity sensors. Additional HMIs shall be capable of being individually averaged for space temperature/humidity readings. All HMIs shall be wired using standard CAT5/6 cables.

6. Factory provided and mounted 120V, 15A unit powered or unpowered convenience outlet.

G. All sensors shall be wired back to the main control board that continuously monitors all critical components and makes decisions based on pre-determined logic to accurately control the following:

1. PID logic to control heater modulation ensuring precise discharge/space temperature control.

2. PID logic to control compressor speed to provide precise control over evaporative coil temperatures, leaving dew point, and discharge/space temperatures.

3. PID logic for Outdoor fan modulation to maintain an optimal outdoor coil temperature.

4. PID logic for Electronic Expansion Valve (EEV) position to maintain a precise superheat temperature

5. PID logic for Modulating Reheat valve to limit supply air temperature and relative humidity based off of space or discharge conditions.

2.10 CONTROLS

A. Refer to Sequences of Operation within Controls specification.

B. BAS Interface: Completely integrated microprocessor based Direct Digital Control (DDC) system to control all functions including space temperature, leaving air temperature, space humidity, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times and diagnostics. The system shall be provided with all required temperature sensors, pressure sensors, controller, and keypad/display operator interface. All microprocessor boards, hardware and software shall be factory provided and installed to enable the BAS to monitor, control, and display unit status and alarms.

C. Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting a fused disconnect device. 24-volt electromechanical control circuit shall include control transformer and contactor pressure lugs for power wiring. Unit shall have single point power entry as standard.

1. Unit controller shall be capable of controlling all features and options of the unit.

2. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

3. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

4. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.

2.11 ROOF CURB (PROVIDED BY RTU MANUFACTURER AND NOT "BY OTHERS"):

A. Roof Curb shall be constructed of G90 galvanized steel and designed to mate with the down flow (confirm arrangement with plans) supply openings and provide support and a watertight seal. The roof curb design shall allow field-fabricated rectangular supply ductwork to be connected directly to the curb. Curb design shall comply with NRCA requirements. Curbs shall be shipped fully welded and insulated and include wood nailer strips.

B. **Curbs shall be rated for a minimum of 155 mph and certified by structural engineer upon submittal. Certification shall be provided within submittal for approval.**

C. Comply with requirements in "The NRCA Roofing Manual."

D. Match roof curb to roof slope to provide level surface for RTU mounting.

E. Provide curb having vertical members insulated with a minimum thermal resistance (R-value) of 6.0 BTU/hr-ft2-°F or greater.

F. Provide curb with continuous insulation between unit base and roof curb. All walls are to be insulated with 2" fiberglass insulation; floor to be insulated with 1" fiberglass insulation.

G. Curb height shall be a minimum of 14".

H. All curbs shall be provided with minimum 12-gauge wind clips.

I. Roof Curb for Horizontal Airflow (where scheduled) - Horizontal openings in curb shall be custom designed for return and/or discharge for horizontal air handling. Opening size and location shall be indicated on drawings and/or schedule.

J. Provide wood nailing strip to which roofer may nail roof flashing.

K. Ship roof curb loose for field installation prior to unit placement.

L. **Curb shall be factory painted with enamel paint. Color: Tan Enamel coating.**

2.12 VARIABLE FREQUENCY DRIVES

A. Provide Variable Frequency Drive for the compressor as part of the AC unit. VFD shall be furnished and installed to meet the performance set forth in the schedule and as specified under another section of this work.

1. Accessories to be furnished and mounted by the drive manufacturer and contained in a single enclosure. (The use of more than one enclosure is not acceptable).

B. Provide Variable Frequency Drive for speed control on all non-ECM direct drive supply fans.

C. All VFDs shall provide the following inherent protections:

1. Phase protection.
2. Brownout protection.
3. Overload/Overheat protection.
4. Soft starts to protect bearings/hardware.
5. Low & High voltage & over-torque protections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.

B. Curb Support: Install roof curb on roof structure according to "The NRCA Roofing Manual."

1. Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction.
2. Coordinate size, installation, and structural capacity of roof curbs, equipment supports, and roof penetrations.
3. Coordinate size, location, and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.

C. Duct-mounted sensors furnished by equipment manufacturer for field installation. Building Automation Systems Contractor shall provide and Install control wiring and make final connections to control devices and unit control panel.

D. Comply with requirements for gas-fired furnace installation in NFPA 54, "National Fuel Gas Code."

E. Install separate devices furnished by manufacturer and not factory installed.

F. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 CONNECTIONS

A. Coordinate installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems.

B. Where installing piping adjacent to units, allow space for service and maintenance.

C. Gas Piping Connections:

1. Comply with requirements in Section 23 11 23 “Natural-Gas Piping."

2. Connect gas piping to furnace, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.

3. Install AGA-approved flexible connectors.

D. Coordinate duct installation requirements with schematics on Drawings and with requirements specified for duct systems.

E. Duct Connections:

1. Comply with requirements in Section 23 31 13 "Metal Ducts."

2. Drawings indicate the general arrangement of ducts.

3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 23 33 00 "Air Duct Accessories."

F. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.

1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.4 STARTUP SERVICE

A. A factory-authorized service representative shall perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Inspect units for visible damage to furnace combustion chamber.

3. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:

a. Measure gas pressure at manifold.

b. Measure combustion-air temperature at inlet to combustion chamber.

c. Measure flue-gas temperature at furnace discharge.

d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.

e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

4. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

a. High-limit heat exchanger.

b. Alarms.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 DEMONSTRATION

A. A factory-authorized service representative shall train Owner's maintenance personnel to adjust, operate, and maintain units.

3.7 COMPLETION AND CLEANUP

B. Contractor shall comb and vacuum clean coils, inside and outside of unit cabinet prior to start-up.

C. Install temporary filters during construction and start-up period. Replace with specified filters at Substantial Completion.

3.8 PROTECTION OF FINISHED WORK

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation

END OF SECTION 23 74 33

SECTION 23 81 26 - DUCTLESS MINI-SPLIT-SYSTEM AIR-CONDITIONERS

PART I -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Indoor, wall or ceiling mounted, direct-expansion fan coils are matched with cooling only outdoor unit.

B. Outdoor air-cooled split system compressor sections suitable for on-the-ground, rooftop, wall hung or balcony mounting. Units shall consist of a rotary compressor, an air-cooled coil, propeller-type draw-through outdoor fan, metering device(s), and control box. Units shall discharge air horizontally as shown on the contract drawings. Units shall function as the outdoor component of an air-to-air cooling only or heat pump system (refer to schedule).

C. Indoor unit shall be rated per ARI Standards 210/240 and listed in the ARI directory as a matched system.

D. A factory provided and installed BACnet communication interface card with building automation system shall enable building automation system operator to remotely control and monitor the system from an operator workstation. Control features available, and monitoring points displayed, locally at fan coil controller shall be available through building automation system.

E. Outdoor unit construction shall comply with ANSI/ASHRAE 15, latest revision, and with the NEC. Units shall be evaluated in accordance with UL standard 1995. Units shall be listed in the CEC directory. Unit cabinet shall be capable of withstanding 500-hour salt spray test per Federal Test Standard No. 141 (method 6061). Air-cooled condenser coils shall be leak tested at 573 psig.

F. Provide equipment with electrical characteristics as shown on the Electrical Drawings.

1.3 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Carrier
2. JCI.
3. LG.
4. Mitsubishi.

1.4 SUBMITTAL:

A. Submit in form similar to the schedule on the Drawings. Show all data listed in schedule, electrical characteristics and accessories being provided.

B. Provide line-by-line specification review annotated to certify compliance or deviation.

C. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures.

D. Product Data: Submit product data, including manufacturer's product sheet for specified products.

1.5 WARRANTY

A. One (1) year on unit parts other than compressor/motor assembly. Warranty shall begin from date of Certificate of Substantial Completion.

B. Five (5) years on compressor/motor assembly. Warranty shall begin from date of Certificate of Substantial Completion.

C. One (1) year on refrigerant and oil. Warranty shall begin from date of Certificate of Substantial Completion.

PART 2 –PRODUCTS

2.1 UNIT CABINET:

A. Indoor unit cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.

B. Outdoor unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked-enamel finish on inside and outside. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.

C. Indoor and outdoor unit shall be of the same manufacturer.

2.2 COMPRESSOR

A. Compressor shall be fully hermetic rotary type. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over-temperature and over-current. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere. Compressor assembly shall be installed on rubber vibration isolators.

2.3 COIL

A. Evaporator coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap.

B. Condenser coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.

2.4 FANS

A. Fan shall be tangential direct-drive blower type with air intake at the top of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard. Air sweep operation shall be user selectable. The vertical sweep may be adjusted (using the remote control) and the horizontal air direction may be set

manually.

2.5 AIR FILTERS

A. Unit shall have filter track with factory-supplied cleanable filters.

2.6 BUILDING AUTOMATION SYSTEM INTERFACE:

A. Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The temperature control range shall be from 62° F to 84°F.

B. The unit shall have integral controls provided by unit manufacturer to perform input functions necessary to operate the system. Factory installed hardware and software to enable building automation system to monitor, control, and display status and alarms.

1. A factory provided and installed BACnet communication interface card with building automation system shall enable building automation system operator to remotely control and monitor the system from an operator workstation. Control features available, and monitoring points displayed locally at fan coil controller shall be available through building automation system.

2. The unit shall be compatible with interfacing with connection to BACnet networks or interfacing with connection to BMS system.

C. The unit shall have the following functions as a minimum:

1. An automatic restart after power failure at the same operating conditions as at failure.

2. A timer function to provide a minimum 24-hour timer cycle for system Auto Start/Stop.

3. Temperature-sensing controls shall sense return air temperature.

4. Indoor coil freeze protection.

5. Wireless infrared remote control to enter set points and operating conditions.

6. Automatic air sweep control to provide on or off activation of air sweep louvers.

7. Dehumidification mode shall provide increased latent removal capability by modulating system operation and set point temperature.

8. Fan-only operation to provide room air circulation when no cooling is required.

9. Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.

10. Fan speed control shall be user-selectable: high, medium, low, or microprocessor controlled automatic operation during all operating modes.

11. Automatic heating-to-cooling changeover in heat pump mode. Control shall include dead band to prevent rapid mode cycling between heating and cooling.

12. Indoor coil high temperature protection shall be provided to detect excessive indoor discharge temperature when unit is in heat pump mode.

PART 3 -EXECUTION

3.1 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, fill water coils with water and test coils and connections for leaks. Repair leaks and retest until no leaks exist.

2. Charge refrigerant coils with refrigerant and test for leaks. Repair leaks and retest until no leaks exist.

3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

3.2 STARTUP SERVICE

A. Refer to Section 23 05 93 Testing, Adjusting, and Balancing for HVAC.

3.3 CLEANING

A. Clean units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing fan coil and air-distribution systems clean filter housings and install new filters.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan coil units.

END OF SECTION 23 81 26

SECTION 23 82 19 - FAN COIL UNITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes factory fabricated fan coil units and accessories.

B. Related Sections:

1. Section 23 05 00 - Common Work Results for HVAC.

2. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

3. Section 23 07 16 - HVAC Equipment Insulation: Product requirements for insulation for placement by this section.

4. Section 23 33 00 - Air Duct Accessories: Product requirements for flexible duct connections for placement by this section.

5. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors for placement by this section.

6. Section 23 05 14 - Variable Frequency Controllers.

1.3 SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Provide line-by-line schedule notes review annotated to certify compliance or deviation.

C. Provide Footprint Square footage Discrepancy Chart in spreadsheet form. Clearly show the differences in height, length, and width between the submitted units and designed units per plans for each FCU with corresponding tag.

D. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

E. Product Data, Submit the following:

1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.

2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.

3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.

4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity per ARI 260.

5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.

F. Manufacturer's Installation Instructions: Submit.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

1.6 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three (3) years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Units shall be factory wrapped by the manufacturer prior to shipment to prevent damage due to weather and road debris during transportation and thereafter while in storage awaiting installation. Protection of the complete unit from rusting and water migration must be handled as best suits the circumstances. Store in a place protected from construction traffic and weather.

B. All equipment shall remain in manufacturer's protective shipping wrap during construction. Openings must remain protected and covered during construction. If

protective wrap has been damaged, the contractor shall provide additional protective wrap as directed by engineer.

C. Contractor shall adequately protect equipment from damage after delivery to the project. Equipment shall be completely covered and secured with heavy tarpaulins, drop cloths or other protective coverings as required to protect from inclement weather, moisture, chemicals, construction traffic, plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion. Protective covering is in addition to the manufacturer's original factory packaging. Original factory packaging shall not be deemed as acceptable protection of equipment.

D. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the contractor is obligated to furnish new equipment of like kind at no additional cost to the Owner. Limit shipment of bulk and multi-use materials to quantities needed for immediate installation.

E. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

F. Protect units from physical damage. Leave factory covers in place until startup of machine.

1.8 WARRANTY

A. Furnish one (1) year manufacturer parts and labor warranty for air handling units. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start up is not acceptable.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Spare materials shall be provided by equipment manufacturer and not by the installing mechanical contractor or "by others".

1. Filters: Furnish three (3) sets for each unit. One set during construction, a new set of filters for Test and Balancing services, and final new set at substantial completion. Filters shall be protected with polyester fabric at all times during construction.

1.10 COORDINATION

A. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 – PRODUCTS

2.2 FAN COIL UNITS

A. Manufacturers: Subject to compliance with plans and specification, provide one of the following:

1. Refer to Specification 01 23 00 Alternates for acceptable manufacturers.

2. All materials and labor costs to coordinate, receive, install and start-up the equipment per this specification for a complete and operational system shall be included in the Contractor's Base Bid.

2.3 MANUFACTURED UNITS

A. Fan coil units shall be factory assembled and consist of fans, motor and drive assembly, coils, filters, stainless-steel condensate pans and accessories.

2.4 CABINET

A. Materials: Formed single-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections gasketed.

1. Outside Casing: 18 gauge, galvanized steel (G90).

2. Utility Lugs: For lifting unit and fastening to permanent structure, 8 gauge, galvanized steel (G90).

B. Cabinet Insulation: Comply with NFPA 90A or NFPA 90B.

1. Materials: Closed cell foam insulation.

2. Thickness: 1 inch.

3. Density: 1 ½ pounds per cubic foot.

4. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.

5. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50, when tested according to ASTM C 411.

C. Access Panels: Same materials and finishes as cabinet complete with threaded bolted fasteners, and gaskets. Inspection and access panels shall be sized and located to allow periodic maintenance and inspections and include hinged access with lift and turn fasteners on both sides of unit. Provide access panels in the following locations:

1. Fan Section: Double wall hinged access doors.

2. Coil Section: Inspection panel.

3. Filter Section: Hinged access doors to allow periodic removal and installation of filters.

D. Condensate Drain Pans: Formed sections of stainless-steel sheet complying with requirements in ASHRAE 62. Fabricate pans with slopes in two planes to collect condensate from cooling coils (including coil piping connections and return bends) when units are operating at maximum catalogued face velocity across cooling coil.

1. Double-Wall Construction: Fill space between walls with 1 inch, 1 ½ pound fiber glass insulation.

2. Drain Connections: Main and auxiliary on same side of fan. Provide auxiliary drain pan connection under unit above ceiling.

3. Float Switch: Provide a factory installed and wired drain pan float switch.

2.5 FAN SECTION

A. Fan-Section Construction: Direct drive centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor drive assembly, and support structure and equipped with formed-steel channel base for integral mounting of fan, motor, and casing panels. Mount fan with interior torsion flex mount and exterior spring vibration isolation.

B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to make curved scroll housings with shaped cutoff, spun-metal inlet bell, and access panels or doors to allow entry to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

2. Horizontal Flanged Split Housing: Bolted construction.

3. Drive Frame: Rail mounted, heavy gauge steel to allow frame to slide for easy belt tensioning.

C. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower.

D. Forward-Curved Fan Wheels: Galvanized-steel and/or aluminum/painted steel construction with inlet flange, back plate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically secured to flange and back plate; cast-steel hub swaged to back plate and fastened to shaft with set screws.

E. Coatings (exterior only): Baked Enamel

F. Shafts: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished Stainless steel with keyway. Ship with a protective coating of lubricating oil.

2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

G. Pre lubricated and Sealed Shaft Bearings: Bearings shall be ball bearing type (no sleeve bearings allowed), permanently lubricated and sealed for life.

H. Fan-Section Source Quality Control:

1. Factory test fan performance for flow rate, pressure, power, air density, rotation speed, and efficiency. Establish ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

I. Inlet/outlet duct collars. Galvanized collars at each inlet and outlet of the unit. Flexible duct connection isolating discharge of scroll from discharge of fan.

2.6 MOTORS

A. General: Comply with requirements in Section 23 05 13 Common Motor Requirements for HVAC Equipment and Division 26. Matched with fan load.

B. Maximum Ambient Temperature Rating: 120 degrees F (50 degrees C).

C. Premium efficiency Electronically Commutated (ECM) with thermal overload protection wired to exterior junction box.

1. Motor size 1/2 HP and 1 HP shall have integrated control module with thermal overload protection. Motor size 1-1/2 HP and 3 HP shall have remote mounted control with thermal overload protection. Motor control module is mounted in cabinet interior.

2. Motors shall be factory wired to unit control box with quick connect electrical plugs.

3. Motors shall be RPM controlled, UL Recognized, or equivalent, continuous duty rated.

4. Motor service access shall be on same side as coil connections.

2.7 COILS

A. Coil Sections: Common or individual, insulated, galvanized-steel casings for heating and cooling coils. Design and construct to facilitate removal and replacement of coil for maintenance and to ensure full airflow through coils.

B. Water Coils: Self-draining coil fabricated according to ARI 410.

1. Piping Connections: Sweat

2. Tubes: Copper, 0.016 inch tube thickness

3. Fins: Aluminum, 10 fins per inch

4. Fin and Tube Joint: Mechanical bond

5. Headers: Seamless copper tube with brazed joints

6. Frames: Galvanized-steel channel frame.

a. Working-Pressure Ratings: 250 psig, 300 deg F.

7. Source Quality Control: Test to 500 psig underwater (2000 psig ultimate strength).

C. Refrigerant Coils: Coil designed for use with R-454B refrigerant, fabricated according to ARI 410, connected with soldered fittings.

1. Capacity Reduction: Circuit for Double control.

2. Tubes: Copper

3. Fins: Aluminum 10 fins per inch.

4. Fin and Tube Joint: Mechanical bond.

5. Suction and Distributor: Seamless copper tube with brazed joints.

6. Frames: 16 gauge, galvanized-steel channel frame.

7. Ratings: Design tested and rated in accordance to UL (UL recognized).

   a. Working-Pressure Rating: 250 psig.

8. Source Quality Control: 500 psig underwater (2000 psig ultimate strength).

D.

2.8 FILTER SECTION

A. Filters: Comply with NFPA 90A.

B. Filter Section: Provide maximum 2” thick filter holding frames arranged for vertical orientations, with hinged access panels on both sides of unit. Filters shall be removable from both sides.

C. Extended-Surface, Disposable Panel Filters: Factory-fabricated, dry, extended-surface filters with holding frames.

1. Media: Fibrous material formed into deep-V-shaped.
2. Media and Media-Grid Frame: Nonflammable cardboard.

D. Replaceable Filter Media: MERV 11 or greater rating in accordance with ASHRAE Test Standard 52.2-2007.

2.9 ELECTRICAL

A. Fan motor shall be wired to an external electrical. Include a motor control board, motor circuit fusing, 24V control circuit transformer, and terminal strip for connection of field wiring.

B. For Constant Air Volume Fan Systems: Provide a dial potentiometer for manual airflow adjustment during test and balancing.

C. For Variable Air Volume Fan Systems: Provide a 0-10VDC input for BAS fan speed control.

D. Provide a single point power connection with factory installed and wired non-fused disconnect switch with lock-out-tag-out ready feature.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with ARI 430.

B. Install assembled units with internal vibration isolators. Internally isolated fans shall be provided with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating. Refer to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Contractor to provide fixed sheaves required for final air balance as dictated by Test and Balance Contractor.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

E. Insulate coil headers located outside airflow as specified for piping. Refer to Section 23 07 19 - HVAC Piping Insulation.

F. Provide trapped condensation drain line routed to the nearest floor drain. Refer to detail on Drawings and Section 23 21 13 - Hydronic Piping.

G. Installation of Hot Water Heating and/or Chilled Water Coil:

1. Make connections to coils with unions. Position unions to permit coil removal.

2. Connect water supply to leaving airside of coil (counter flow arrangement).

3. Locate water supply at bottom of supply header and return water connection at top.

4. Install water coils to allow draining and install drain connection at low points.

5. Install the following piping accessories on piping connections. Refer to Section 23 05 19 – Meters and Gages for HVAC Piping.

   On supply: (refer to coil connection details)

   1. Thermometer well and thermometer.
   2. Well for control system temperature sensor.
   3. Shutoff valve.
   4. Pressure gage.
   5. Y-Strainer

   On return: (refer to coil connection details)

   1. Victaulic / TA 78K (combination balancing / shut-off globe valve with memory stop and pressure / temperature ports).
   2. Air vent.
   3. Thermometer well and thermometer.
   4. Well for control system temperature sensor.
   5. Pressure gage.
   6. Modulating control valve (furnished and installed by BAS).
   7. Shutoff valve.

6. Install valves and piping specialties in accordance with details as indicated on Drawings.

7. Install manual air vents at high points complete with shutoff valve. Refer to Section 23 21 13 - Hydronic Piping.

8. Install floor support stands at piping drops to air unit coil connections. Air unit coil shall not carry any suspended piping load.

H. Fan coil unit manufacturer representative shall remove vibration isolation shipping blocks prior to start-up and ensure that fan base is free floating, and isolators are not short circuited during operation.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to low profile fan coil units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans, to drainage piping. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 23 21 13 Hydronic Piping. Connect to supply and return coil tappings with shutoff or balancing valve and union or flange at each connection.

F. Condensate Piping: Comply with applicable requirements in Section 23 21 13 Hydronic Piping. Connect to supply and return coil tappings with shutoff valve and union or flange at each connection.

G. Refrigerant Piping: Comply with applicable requirements in Section 23 23 00 Refrigerant Piping. Connect to supply and return coil tappings with shutoff valve and union or flange at each connection.

H. Duct installation and connection requirements are specified in Section 23 31 00 HVAC Duct and Casings.

I. Electrical: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

J. Ground equipment according to Division 26.

K. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks.

2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify that shipping, blocking, and bracing are removed.

3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.

4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.

5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.

6. Verify that zone dampers fully open and close for each zone.

7. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.

8. Comb coil fins for parallel orientation.

9. Verify that proper thermal-overload protection is installed for electric coils.

10. Install new, clean filters.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.

2. Measure and record motor electrical values for voltage and amperage.

3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.6 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units externally and internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, comb coils, drain pans, and filter housings, and install new, clean filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan coil units.

3.8 PROTECTION OF FINISHED WORK

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION 23 82 19

SECTION 23 82 39.19 - ELECTRIC UNIT HEATERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electric Unit Heaters.

B. Related Sections:

1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers for placement by this section.

2. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

1.3 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.

2. ASHRAE 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers.

B. Underwriters Laboratories Inc.:

1. Units to be UL Listed.

1.4 ACTION SUBMITTALS

A. Provide line-by-line specification review annotated to certify compliance or deviation.

B. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.

2. Location and size of each field connection.

3. Details of anchorages and attachments to structure and to supported equipment.

4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.

5. Location and arrangement of integral controls.

6. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.

2. Structural members to which unit heaters will be attached.

3. Method of attaching hangers to building structure.

4. Size and location of initial access modules for acoustical tile.

5. Items penetrating finished ceiling, including the following:

6. Lighting fixtures.

a. Air outlets and inlets.
b. Speakers.
c. Sprinklers.
d. Access panels.

7. Perimeter moldings for exposed or partially exposed cabinets.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of thermostats or other products not mounted on unit.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Accept heaters and controls on site in factory packaging. Inspect for damage.

1.9 WARRANTY

A. Furnish a five (5) year manufacturer warranty. Warranty shall begin from date of Certificate of Substantial Completion. Warranty start date from shipment or start-up will not be acceptable.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. Manufacturers: Subject to compliance with scheduled capacities and specification, provide products by the following manufacturers.

1. Chromalox
2. Markel
3. Modine
4. Reznor
5. Trane

B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, controls, and accessories complying with ARI 440:

1. Discharge Louvers: Individually adjustable horizontal and vertical louvers to match cabinet finish.

2. Control Voltage: 24-volt, 60 hertz

3. Wall mounted adjustable thermostat.

4. Location: Suspended overhead.

5. Comply with UL 2021.

C. Cabinet: 18-gauge steel with baked enamel finish, easily removed and secured access panels, insulated or double panel construction.

D. Supply Fan: Propeller type with direct drive, dynamically balanced and mounted with rubber vibration insulators.

E. Heat Exchanger: High mass, all steel tubular finned type, copper brazed elements.

F. Controls: Wall mounted Thermostat with fan switch.

G. Motor: Totally enclosed industrial rated. Motor on units to 20KW shall utilize sealed bearings. Motor on units larger than 20KW shall be 2-speed, permanent capacitor-type, continuous duty.

H. Wiring:

1. Sub-divided circuits with individual fuse protection

2. Internal 24V control transformer.

3. Heavy duty magnetic contactors.

4. Thermal cutouts on control circuit with automatic reset.

5. Low voltage thermostatic kit with fan switch.

6. Factory wired disconnect switch.

7. Performance: Provide equipment as scheduled on Drawings.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cabinet unit heaters to comply with NFPA 90A.

B. Install unit heaters level and plumb.

C. Suspend cabinet unit heaters from structure with elastomeric hangers. Refer to Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

E. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Comply with safety requirements in UL 1995.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.

3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature set points.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 23 82 39.19

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUBSTITUTIONS OF PRODUCTS

A. The products described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an Addendum as a substitution prior to the submission of proposals.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect and Engineer at a minimum of seven (7) business days prior to the date for receipt of proposals. Each such request shall include a specification line by line review annotated to certify compliance, the name of the manufacturer and model, material or equipment for which it is to be substituted and a complete description of the proposed substitute including dimensional drawings, cutsheets, performance and test data and any other information necessary for an evaluation. The Engineers decision of approval or disapproval of a proposed substitution shall be final.

C. If the Engineer approves any proposed substitution prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

D. The Engineer and Owner reserve the right to disapprove the use of any manufacturer who in their judgment is unsuitable for use on the Project and that decision will be final.

E. Availability of specified items:

1. Verify prior to submittal of Proposal that all specified items will be available in time for installation during orderly and timely progress of the work.

2. In the event specified items will not be so available, notify the Architect / Engineer prior to receipt of Proposals. Submit Request for Substitutions in accordance with this section.

3. The request will not be considered if the product or method cannot be provided as a result of the Contractor’s failure to pursue the work promptly or coordinate activities properly.

4. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by the Owner.

F. A request constitutes a representation that Offeror:

1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.

2. Will provide same warranty for Substitution as for specified product, except when inability to provide specified Warranty is reason for request for substitution as described above.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse the Owner and pay for all costs, including Architect/Engineer's redesign and evaluation costs resulting from the use of the proposed substitution, or for review or redesign services associated with re-approval by authorities having jurisdiction.

G. **No substitutions will be considered after the Award of Contract.**

1.3 SUMMARY

A. Provide all work for electrical systems required in the project to be properly installed, tested and performing their intended function.

1.4 QUALITY ASSURANCE

A. Perform all work in accordance with the latest edition of the national electrical code, and local codes.

B. All electrical materials and distribution, and utilization equipment shall be UL Listed.

C. All equipment and materials shall be new and unused and of United States Domestic manufacture unless approved otherwise by engineer or owner.

D. Eliminate any abnormal sources of noise that are considered by the architect not to be an inherent part of the electrical systems as designed.

1.5 COORDINATION WITH OTHER TRADES

A. Coordinate the work of this division with all other divisions to ensure that all components of the electrical system will be installed at the proper time and fit the available space.

B. Locate and size all openings in work of other trades required for the proper installation of the electrical system components.

C. Make all electrical connections to all equipment furnished by this division and any other division.

D. Make all electrical connections from all 120 volt and greater dampers and switches to associated exhaust fan(s) furnished by any other division.

1.6 DRAWINGS

A. The drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Determine exact locations by review of equipment manufacturer's data, by job site measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. The size of the electrical equipment indicated on the Drawings may be based on the dimensions of a particular manufacturer. While other listed manufacturers will be acceptable, it is the responsibility of the Contractor to determine if the equipment that Contractor proposes to furnish will fit in the space. The drawings are not intended to show exact locations of conduit and wire, or to indicate all wire terminators, connectors, conduit fittings, boxes or supports, but rather to indicate distribution, circuitry, and control.

B. The Electrical Drawings are necessarily diagrammatic in character and cannot show every connection in detail or conduit in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. ***In all open-to-structure spaces, including those with ceiling clouds of any size, all wiring less than 120V shall be installed in conduit***. Work shall be installed to avoid crippling of structural members. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. When the mechanical and electrical Drawings do not give exact details as to the elevation of pipe, conduit and ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Exposed conduit is generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets and their location details. Work shall be concealed in all finished areas.

1.7 SUBMITTALS

A. Specification Review:
   1. Include a paragraph-by-paragraph written specification review for each product listed requiring a submittal. Denote any proposed deviations from specifications.

1.8 EXISTING CONDITIONS

A. Do all work required to maintain electrical services to the Owner occupied portions of the building during construction.

B. No connection to existing services or utilities shall be made without Owner's knowledge and permission. All such connections shall be planned and scheduled to minimize the length of service interruption required. Request for shutdown shall be made to Owner at least two (2) weeks in advance and shall be accompanied by detailed written schedule of activities during shutdown and list of materials required for connection and renewal of service. It shall be understood that all such service interruptions shall be made at the Owner's convenience, not the Contractor's. No increase in contract amount will be

allowed for reasons of premium time, inefficiency of operations or other considerations not calculated in original bid.

C. All items removed shall be stored on-site. Schedule a review of the items with the Owner. Remove from site all items the Owner does not choose to keep. Deliver Owner designated items to Owner's storage facility.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

A. Provide allowance in bid for twenty-five 20A/1p circuits of 100 feet in length from source for miscellaneous needs during the course of construction. Include one duplex receptacle per circuit, all associated labor and all necessary accessories (conductor, conduit, supports, etc.) required for proper installation.

B. Provide allowance in bid for twenty-five light switching circuit drops of twenty feet in length for miscellaneous needs during construction. Include one 277V light switch per circuit, all associated labor and all necessary accessories (conductor, conduit, supports, etc.) required for proper installation.

C. Provide allowance in bid for ten additional exit signs for miscellaneous needs during construction. Include circuiting, all associated labor and all necessary accessories required for proper installation.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary wiring and connections to maintain existing systems in service during construction.

C. When performing work on energized equipment or circuits, use personnel experienced and trained in similar operations.

D. Remove, relocate, and extend existing installations to accommodate new construction.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

3.2 OWNER INSTRUCTION

A. Provide on-site Owner training for all new equipment.

B. Use Operation and Maintenance manuals and actual equipment installed as basis for instruction.

C. At conclusion of on-site training program have Owner personnel sign written certification they have completed training and understand equipment operation. Include copy of training certificates in final Operation and Maintenance manual submission.

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide a complete system of building wire and cable to all electrical loads.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Provide stranded conductors for all wiring.
   2. Conductor not smaller than 12 AWG for power and lighting circuits.
   3. Conductor not smaller than 16 AWG for control circuits.
   4. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet
   5. 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
   6. Copper.

B. Wiring Methods: Provide the following wiring methods:
   1. Concealed Dry Interior Locations: Use only Type THHN/THWN-2 insulation, in raceway.

C. Branch Circuit Conductors: No branch circuit conductors are allowed in any slab or under slab on grade unless specifically indicated on drawings.

1.4 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:
   1. Southwire
   2. Republic
   3. Alan
   4. Encore

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

D. Insulation: NFPA 70; Type THHN/THWN-2 insulation for feeders and branch circuits.

2.2 TYPE AC CABLE

A. Manufacturers:
   1. AFC
   2. Southwire

B. Product Description: A fabricated assembly of insulated conductors in a flexible metallic enclosure.

C. Comply with NEC 320.

D. Support, provide separate support to structure for all Type AC cable, spacing not exceeding three (3) feet and at each junction box.

E. Provide an insulated green grounding conductor in all Type AC cable.

F. Acceptable Use: Install, at Contractor's option, only for service to light fixtures above accessible ceilings, limit length to six (6) feet whips from accessible junction box to light fixtures.

G. Provide insulated throat fittings at all terminations of Type AC cable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify interior of building has been protected from weather.

B. Verify mechanical work likely to damage wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques - Wiring Connections:
1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
   a. MDF/IDF room branch circuits: All branch circuits shall be dedicated and unspliced. Provide dedicated branch circuit 20 or 30 amperes, #10 and or #12 wire, unspliced from wiring device all the way back to the overcurrent device. Do not share ground with any other circuit.
   b. Computer branch circuits: All branch circuits shall be dedicated. Provide dedicated branch circuit 20 amperes, #10 and or #12 wire from wiring devices all the way back to the overcurrent device. Do not share neutral with any other circuit.
   c. Kitchen branch circuits: All branch circuits for 125 volt, single phase, 15 and 20 ampere receptacles shall be dedicated. Provide dedicated branch circuit 20 amperes, #10 and or #12 wire from wiring devices all the way back to the overcurrent device. Do not share neutral or ground with any other circuit.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

3.4 WIRE COLOR

A. COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

	Wire Sizes #10 and Smaller: Use Continuous Color Coded Insulation (Note 01)				**Wire Sizes #6 and Smaller: Use Continuous Color Coded Insulation (Note 02)**	
System/Phase	**A**	**B**	**C**	**N**	**G**	**IG**
120/208	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240	Black	Orange	Blue	White w/color stripe (Note 03)	Green	Green/Yellow Stripe
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Table Notes:

1. Wire size #8 and larger, black conductors with color marking tape at each termination and where accessible; colors as noted above.

2. Wire sizes #4 and larger, black conductor with green marking tape at each termination and where accessible.
3. Provide white (no stripe) insulation when 120/208V system is not present at this installation.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number and provide color coding at each junction box containing more than one neutral.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
For 6 AWG and smaller: Green.
For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 GROUPING OF CIRCUITS

A. Limit the number of current carrying conductors per conduit to 6. Neutrals serving computer receptacle branch circuits shall be counted as current carrying. Grounds shall not be counted.

B. Grouping of different voltages is not allowed.

C. Provide metal box sizes per NEC Table 314.16 (A).

D. Provide conduit per NEC Annex C.

E. Neutrals serving branch circuits shall not be shared. Provide dedicated neutral per circuit.

3.6 POWER LIMITED CIRCUIT INSTALLATION

A. Provide a complete system of raceway and covered junction boxes for all power limited circuits installed exposes in finished spaces and spaces without a ceiling.

B. Provide raceway for all power limited circuit wiring within wall cavities and above sheet rock, plaster and other “hard” (non-lay-in) ceiling types of construction.

C. Labeling: Provide label on all junction boxes.
1. Provide permanent labeling with indelible black marker, in neat, legible print indicating the system wiring name.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide a continuous low-impedance grounding system for the entire electrical wiring system.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
   2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. NFPA 70 - National Electrical Code.

1.4 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
   1. Metal underground water pipe.
   2. Metal building frame.
   3. Concrete-encased electrode.
   4. Rod electrode.
   5. Plate electrode.

1.5 SUBMITTALS

A. Product Data: Submit data on grounding electrodes and connections.

1.6 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.7 MADE ELECTRODE INSPECTION

A. Convene prior to cover up of work of this section.

B. Coordinate inspection of made electrode, exothermic welds and test well installation.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Manufacturers:
1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. O-Z Gedney Co.
5. Thomas & Betts
6. VFC

B. Product Description:
1. Material: Copper-clad steel
2. Diameter: 3/4 inch
3. Length: ten (10) feet

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: #2 AWG.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.3 MECHANICAL CONNECTORS

A. Manufacturers:
1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. ILSCO Corporation
5. O-Z Gedney Co.
6. Thomas & Betts, Electrical
7. VFC

B. UL Listed for grounding applications.

C. Provide “ACORN” style ground clamp only for all driven ground rods unless noted to be exothermic connected in this specification. UL listed for connecting ground conductor to a driven ground rod.

D. Description: Brass connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Cadweld by Erico, Inc.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.5 GROUNDING BUSSES

A. When indicated, provide copper ground busses on walls in areas where special grounding needs will arise. Bus shall consist of copper bar as follows:
1. Ground bar cross section of nominal four (4) inches by 1/4 inch; 24 inches length.
2. Drill to accommodate NEMA Pattern D 2-hole compression lugs for ground wires to be installed. Leave remainder of bar for future drilling by owner.
3. Copper compression lugs to connect conductors to the bar. Lugs shall be 2-hole type for double bolting to ground bar.
4. Install all bolts for compression with top and bottom steel washers plus a Belleville spring washer between top washer and bolt head.
5. Grounding electrode conductor(s) shall be fusion-welded on buss (and not lugged on).
6. Mounting Free air, no enclosure required. Install Harger WBKT-1 brackets to mount bar to wall. Isolate copper bar from mounting brackets with Harger 4200-Seriess two (2) inch insulators.
7. Fasten clear pexiglass cover on standoff bolts over ground bar. Engrave cover "GROUND BUS". Cover by Harger Lightning Protection, Inc., or approved equal.
8. Ground bar assembly shall be Harger Lightning Protection, Inc. GBI Series (800-842-7437, www.harger.com), Erico, Inc. (800-248-9353) or approved equal.

2.6 DRIVEN ELECTRODE ACCESS WELL AND COVER

A. Eight (12) inch diameter concrete pipe with belled end.

B. 24 inches long or longer to reach ground and set flush in grade.

C. Provide cast iron cover with "GROUND" embossed on top.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, and surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods compatible with existing electrical installations.

3.4 INSTALLATION

A. Install in accordance with NEC Article 250. Properly bond the system neutral to the system grounding electrode conductor at the main service entrance equipment. Route the grounding electrode conductor to, and bond to, the grounding electrode system. All other neutral busses, bars, etc. on the service voltage system shall be isolated from ground. This system shall be the solid grounded type.

B. Bond all ground electrodes together to form the grounding electrode system including metal underground water pipe, metal frame of the building or structure, concrete encased electrodes, ground ring, rod and pipe electrodes and plate electrodes.

C. Install grounding and bonding conductors concealed from view.

D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing.

E. Install a green equipment grounding conductor in all feeders and branch circuits, minimum size per NEC Table 250.122.

F. Transformers: Ground as a separately derived source.
1. Where transformer secondary includes a neutral, the neutral shall be bonded to the equipment enclosure and connected to the system ground conductor.
2. Size bonding jumper per NEC Table 250.66.
3. Grounding conductor shall be in raceway and shall be bonded to nearest available point of interior metal water piping system.

G. Bond together reinforcing steel and metal accessories in pool and fountain structures.

H. Concrete-Encased Electrode (NEC 250-52):
1. Concrete-encased electrode is also known as the "Ufer ground". Concrete footings or foundation that are in direct contact with the earth and located at the building periphery shall be made available for use as electrodes. Designated footings shall be used for grounding purposes. Unless other wise noted on drawings, designated footings are the perimeter building corners plus perimeter footings approximately on 100 feet centers between corners.

I. Made Electrode:
1. Triple Ground Rod: Provide a building ground rod and bond it to the electrode system. The building ground rod shall consist of three ground rods, arranged in an equilateral triangular pattern located at least five (5) feet outside an exterior building wall or as otherwise directed. Space 15 feet apart and drive into the earth to a point two (2) feet below finished grade to top of rods. Grounding electrode conductor shall form a continuous loop around rods, and conductor shall be properly bonded to each rod by a fusion weld similar to "Cadweld".
2. Extend grounding electrode conductor from this ground rod(s) to the grounded service conductor (neutral) in the building main switchboard at an accessible point on the ground bus per NEC 250-24.
3. Install grounding electrode conductor of 3/0 Copper.

J. Main Bonding Jumper: Shall be sized in accordance with Section 250-66, if not indicated on the drawings, and installed within the same enclosure as the point of bonding of the system neutral service entrance.

K. Grounding Busses:

1. Provide a copper bus bar where indicated on Drawings. Provide grounding electrode conductor and connection to the grounding electrode system. AWG No. 2 minimum.
2. Provide in each IDF and MDF room.
3. Provide at each CATV / MATV head-end mounting board.
4. Provide at each building communications rack.
5. Provide at each sound reinforcement equipment rack.

L. Water Pipe Electrode: A ten (10) foot minimum length of electrically continuous underground metal water pipe. Bond around insulating joints or sections, insulating pipe, and water meters to make pipe electrically continuous.

M. Metal Building Frame NEC 250-52.
1. The structural steel or other metal frame of the building. Effectively ground the steel structural columns to the ground ring electrode.
2. Cadweld AWG #2 bare copper cable to base of steel column. Route bonding jumper down through column blockout in building floor slab, excavate under grade beam, and extend out to the ground ring. Cadweld jumper (also called "stinger") or install Burndy Hyground™ Type YGHP-C hydraulic compression connector onto ground ring. Install a ground rod at each point where a stinger from a building steel column lands on the ground ring.

N. Fuel Gas Piping:
1. Each above ground portion of a gas piping system upstream from the equipment shutoff valve shall be made electrical continuos and bonded to the building grounding electrode system, as required in NFPA 54, National Fuel Gas Code.
2. Gas piping shall not be used as a grounding electrode.

O. Engine Generator Neutral:
1. Ground the generator neutral as a separately derived system per NEC 250-20(d).
2. Sign: Provide a sign at the service entrance equipment indicating type and location of on-site generator.

P. Outdoor Lighting Poles:
1. All metallic outdoor poles and luminaries on metallic or non-metallic lighting poles shall be grounded by bonding in an approved manner to the circuit grounding conductor. In addition to this, bond pole to a #8 bare copper wire which shall also be bonded to a ground rod. Install the ground rod adjacent to the pole base with the top driven at least two (2) feet below grade.

3.5 OTHER GROUNDING SYSTEMS:

A. General Check the drawings for special grounding system or grounding requirements.

B. Telephone and data equipment grounding connections:
1. Bond each telephone and data equipment ground (buss type or grounding conductor type) at each telephone terminal board and data rack back to the service entrance grounding electrode system with a bare #6awg ground wire.

C. Other Buildings Served From Common Service:
1. The main building service is the source for electric service to several out buildings on site.
2. Isolate neutral bus from ground at each out-building main panel.
3. Provide an equipment grounding conductor in feeder to each out-building main panel.

4. Provide a local building ground rod at each out-building. Bond at least one building column footing to the ground rod.
5. Bond grounding conductor of building main feeder to grounding electrode system established at the particular building.

3.6 EQUIPMENT GROUNDING SYSTEM

A. General: Make a firm bond between all enclosures, equipment and metallic raceway system. Grounding conductors shall be continuous from origin to termination and properly bonded with lugs at both ends. The metallic raceway systems shall be made up properly to form a grounding path that has an impedance back to the main system ground that is as low as can be practically obtained.

B. Over 250 Volts: Provide locknuts and/or listed fittings per NEC 250-97 for bonding of metal raceways in all circuits of over 250 Volts to ground. In case of oversized, concentric or eccentric knockouts, comply with NEC 250-92(B). The use of snap-in, wedge-type, or pivot-type connectors is prohibited.

3.7 FIELD QUALITY CONTROL

A. Grounding Tests:
1. Test the electrical system after installation is complete. Inspect and test for stray currents, unintended ground shorts, and proper physical condition of grounding system. Correct any deficiencies and re-test to verify satisfactory installation.
2. Provide written test report to document all findings, test values, work done and certification of grounding system.
3. Use true-RMS meters for all voltage and current measurements.
4. Test telecommunications grounding riser to verify continuity.
5. Check all isolated ground receptacles for correct polarity.
6. Test all sub panels of separately derives systems to verify subpanel neutral is isolated from ground.
7. Test theater isolated power system for the sound reinforcement system to verify isolation of ground system from other building systems.
8. Verify continuity and isolation of audio system ground bus and grounding riser.
9. Perform ground resistance and continuity testing in accordance with IEEE 142.
10. When improper grounding is found on receptacle, check receptacles in entire project and correct. Perform retest.

3.8 TEST WELLS

A. Install test well for designated outdoor driven ground rods. Set tops of well flush with finished grade. Provide mechanical connector for ground rod inside test well so that rod can be disconnected from ground ring or other grounding electrode system for testing.
1. Designated Ground Rods:
   a. One (1) at triple ground rod for High School Main Switchboard Electrical Room.
   b. One (1) at each generator.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.3 REFERENCES

A. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL - Fire Resistance Directory.

1.4 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to Building Code and UL for fire resistance ratings and surface burning characteristics.

1.6 SUBMITTALS

A. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with the Building Code.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. Electroline Manufacturing Company
3. O-Z Gedney Co.
4. Appleton

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SLEEVES

A. Sleeves for raceway Through Non-fire Rated Floors: 18 gage galvanized steel.

B. Sleeves for raceway Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

C. Sleeves for raceway Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL Listed.

D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 SPRING STEEL CLIPS

A. Product Description: Mounting clamp, and screw.

2.5 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. NMP Corporation

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products .
6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

2.7 FIRESTOPPING ACCESSORIES

A. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

B. General:
1. Furnish UL Listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

C. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors or preset inserts as required.
   2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners or welded fasteners as required.
   3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors as required.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts or hollow wall fasteners as required.
   5. Solid Masonry Walls: Provide expansion anchors or preset inserts as required.
   6. Sheet Metal: Provide sheet metal screws.
   7. Wood Elements: Provide wood screws.

B. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over four (4) inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to suspended ceiling support system, pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
   2. Install surface mounted cabinets and panelboards with minimum of four anchors.
   3. In wet and damp locations install steel channel supports to stand cabinets and panelboards one (1) inch off wall.
   4. Support vertical conduit at every floor.

3.3 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Place intumescent coating in sufficient coats to achieve rating required.

F. Remove dam material after firestopping material has cured.

G. Fire Rated Surface:
1. Seal opening at all rated floors and walls as follows:
a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
c. Pack void with backing material.
d. Seal ends of sleeve with UL Listed fire resistive silicone compound to meet fire rating of structure penetrated.
2. Where cable tray, bus, or conduit, penetrates fire rated surface, install firestopping product ins accordance with manufacturer's instructions.

H. Non-Rated Surfaces:
1. Seal opening through non-fire rated floors and walls as follows:
a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
c. Install type of firestopping material recommended by manufacturer.
2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

3.4 INSTALLATION - SLEEVES

A. Exterior watertight entries: Provide mechanical sleeve seals.

B. Interior conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors and walls one (1) inch above finished floor level. Caulk sleeves.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.1 SUMMARY

A. Section includes conduit and tubing, wireways, outlet boxes, pull and junction boxes, and

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
   3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal junction and pull boxes. Provide flush mounting outlet box in finished areas.

C. Concealed Dry Locations: Provide rigid steel intermediate metal conduit on electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

D. Exposed Dry Locations: Provide rigid steel conduit, intermediate metal conduit or electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

E. In Slab or Under Slab on Grade: No branch circuit raceway is allowed in any slab or under slab on grade unless specifically indicated on drawings.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

1.6 COORDINATION

A. Coordinate installation of outlet boxes and raceway for equipment connected under other Divisions.

B. Coordinate installation of conduit for control wiring in mechanical rooms and in inaccessible locations such as walls and hard ceilings.

C. Coordinate installation of conduit for all other low-voltage systems in inaccessible locations and all other locations required by drawings or specifications for those systems.

D. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes. Refer to Architectural elevations and equipment specifications and coordinate device locations prior to electrical rough-in.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:
1. Carlon Electrical Products
2. Hubbell Wiring Devices
3. Thomas & Betts Corp
4. Walker Systems Inc.
5. The Wiremold Co.
6. Multi Cell
7. O-Z Gedney
8. Raco.
9. or approved equal.

B. Rigid Steel Conduit: ANSI C80.1.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit

E. Electrical Metal Tubing (EMT): All EMT fittings shall be steel not die-cast metal. All conduit stub-ups above ceiling for low voltage and data to be provided with insulating bushing.

F. Flexible Metal Conduit (Flex): Conduit fittings shall be steel. Provide plastic anti-short bushing for all flex fittings. Comply with NEC 348.

G. Liquidtight Flexible Metal Conduit: Shall be same as flexible metal conduit specified above except Article 350 in NEC.

H. PVC-Coated Rigid Steel Conduit: Galvanized rigid steel with additional external coating for 40 mil polyvinyl chloride jacket (PVC). Conforming to UL Standard 6. ANSI C80.1 and NEMA Standard No. RN.1.
   1. Manufacturer:
      a. Ocal Inc.
      b. Perma Cote Industries
      c. Rob-Roy Industries
      d. or Approved equal.

I. PVC-Rigid Nonmetallic Conduit: PVC and fittings that are listed per the UL Standards. Comply with NEMA Standard TC-2.

J. Nonmetallic Multi Duct: Provide nonmetallic multi duct that is UL Listed.
   1. Type: four (4) inches schedule 40 PVC outer duct, four 1.25 inch ducts of ribbed polyethylene. Duct shall have six (6) inch deep end bell on one end, spigot on the other end.
   2. Multi Duct shall have gaskets to seal the inside and outside walls of the inner duct.

2.2 ENCLOSURES

A. Pull Boxes, Junction Boxes, Cabinets, and Wireways: Provide pull boxes, junction boxes, wireways, and cabinets wherever necessary for proper installation of various electrical systems according to the National Electrical Code and where indicated on the Drawings.

B. Minimum Size: That size shown on the drawings, as required for the specific function, or as required by the National Electrical Code, whichever is larger.

C. Construction:
   1. Indoors in Dry Areas and Not Buried in Slab: Code gage steel - NEMA 1 construction - sides formed and welded, screw covers unless indicated hinged cover or door on drawings. Hinged doors shall be similar to panelboard doors with the same type locking device. Knockouts shall be factory made or formed O-Z Gedney Type PB or approved equal.
   2. Outdoors or Indoors in Wet Areas and Not Buried in Slab: Same as specified above for indoor except provide NEMA 3R (designated by 3R or RT) unless indicated or specified to be NEMA 4 (designated by 4 or WP) or other type rating.
   3. Indoors Buried in Slab: Watertight, galvanized cast iron in floors on or below grade, otherwise concrete tight stamped steel.
   4. Outdoors Buried in Earth: Watertight, Polymer concrete similar to Hubbell Power System, Inc. “Quazite” or precast concrete type manufactured by Brooks Product, Inc brand for Oldcastle Precast, Inc. Precast box shall have appropriate structural rating for intended use. Install on a level poured concrete base to provide a solid bearing surface. Provide a bolted cast iron traffic cover with foundry-cast marking "Electrical", "Communications" or "Telephone" as applies. Top of enclosure shall be one (1) inch above finished grade in earth. Top of enclosure shall be flush with finished pavement.

2.2 WIREWAY

A. Manufacturers: Same as Metal Conduit.

B. Product Description: General purpose.

C. Size: As determined by Contractor in accordance with NEC 376.

D. Cover: Screw cover.

E. Connector: Slip-in.
F. Fittings: Lay-in type.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.3 OUTLET BOXES

A. Manufacturers: Same as Metal Conduit.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

C. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Furnish gasketed cover by box manufacturer.

D. Wall Plates: As specified in Section 26 27 26.

2.4 FLOOR BOXES

A. UL listed for wet application, watertight cast-iron, scrub-shield compliant.

B. NEMA OS-1, sheet steel outlet boxes, device boxes, covers, and box supports.
1. Floor: Fully adjustable before and after pour.
2. UL Listed for wet application when installed into concrete, stone, tile or floor without carpet cover. Provide carpet flange where installed in carpet.
3. Provide watertight, cast iron on floors at or below grade, and provide concrete tight stamped steel on all upper floors.
4. Multi Gang Floor Box: Fully adjustable watertight cast iron gang floor boxes where shown on Drawings. Provide with removable partition and provide conduit openings in boxes as required. Install power circuits in separate raceway from data, telephone or other signal.

C. Manufacturers:
1. Appleton
2. Carlon
3. Crouse-Hinds
4. Hubbell
5. FSR
6. Wiremold/Legrand

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION - RACEWAY

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 25 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

E. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

F. Arrange raceway supports to prevent misalignment during wiring installation.

G. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

H. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29.

I. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

J. Do not attach raceway to ceiling support wires or other piping systems.

K. Construct wireway supports from steel channel specified in Section 26 25 29.

L. Route exposed raceway parallel and perpendicular to walls.

M. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

N. Maximum Size Conduit in Slab Above Grade: 3/4 inch.

O. Maintain clearance between raceway and piping for maintenance purposes.

P. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees Fahrenheit.

Q. Cut conduit square using saw or pipe cutter; de-burr cut ends.

R. Bring conduit to shoulder of fittings; fasten securely.

S. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

T. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes. DO NOT route conduit through the top of any outdoor disconnects, panels, etc. conduits must be routed through side or bottom only.

U. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than two (2) inch size.

V. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

W. Install fittings to accommodate expansion and deflection where raceway crosses expansion joints.

X. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

Y. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

Z. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

AA. Close ends and unused openings in wireway.

BB. Provide tracer wire on all underground raceway outside building slab on grade.

3.4 RACEWAY TYPES

A. The following raceway types are to be used in the following locations:
   1. Under Slab on Grade: Schedule 40 PVC.
   2. Outdoor Locations, Above Grade: Rigid galvanized steel.
   3. Wet and Damp Locations: Rigid galvanized steel.
   4. Exposed or Concealed Dry Locations, Indoors: EMT, IMC, or rigid galvanized steel.
   5. Underground:
      a. All underground electrical wire in schedule 40 PVC or rigid galvanized steel, 208 volts or greater shall be encased in red concrete two (2) inches thick on all sides. Encasement not required under building slabs, parking lots or other paved surfaces. Red dye may not be applied to the top of the concrete.
      b. All underground electrical wire in schedule 40 PVC or rigid galvanized steel, 120 volts or less shall have red warning tape 6” above raceway.
   6. Transformers and Motors: 24 inch flexible metal conduit to equipment.
   7. Kitchens and outdoor motor and transformer connections: Liquidtight flexible metal conduit for all exposed raceway.

8. Cooling Towers: PVC coated rigid galvanized steel within 50 feet of tower.

3.5 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings and as approved by the Architect.

B. Adjust box location up to ten (10) feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 126 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Do not fasten boxes to ceiling support wires or other piping systems.

G. Support boxes independently of conduit. Provide rigid support to structure for all junction boxes. Mount junction boxes within 18” of finished ceilings to facilitate future access. Locate junction boxes to allow ready access to junction box covers without removing any equipment.

H. All outdoor boxes shall be UL listed for wet location service.

I. Provide rigid support to structure for all junction boxes.

J. Provide rigid support to structure for all conduit within 3 feet of each junction box and a maximum spacing of 10 feet.

K. Install junction boxes above ceilings in readily accessible with no obstructions, locate within 18 inches of finished ceiling to facilitate easy access.

L. For all flexible whips to light fixtures provide wire support at mid-length of whip to structure above with UL listed conduit support clip.

M. Provide outlet boxes to meet depth requirement of Architectural walls. Refer to Architectural Spec Section 09250 and 10611 for wall partitions.

3.6 ADJUSTING

A. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

3.8 INSTALLATION - FLOOR BOXES

A. Use cast floor boxes for installation in slab on grade.

B. Set floor boxes level.

C. Install boxes and fittings to preserve fire resistant rating of slabs and other elements, using materials and methods specified in Section 26 05 29.

3.9 ADJUSTING

A. Adjust floor box flush with finish material.

3.10 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

3.11 ABOVE CEILING JUNCTION BOXES

A. Labeling: Provide label on all above ceiling junction boxes.
   1. Provide permanent labeling with indelible black marker, in neat, legible print indicating the panelboard name, branch circuit number(s) and voltage of conductors within the junction box. Junction boxes used for emergency power circuits to be painted red.

B. Color Code: All Electrical junction boxes above ceiling shall be colored as follows.
   1. Yellow for 277V lighting
   2. Blue for 120V regular power
   3. Green for 120V computer power
   4. Brown for 277/480V equipment
   5. Red for emergency power

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Underground Warning Tape.
   3. Lockout Devices.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical identification, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and standards: Comply with the following:
   1. National Electrical Code, NFPA No. 70.
   2. NEMA standards applicable to the product provided.
   3. UL standards applicable to the product provided.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:
   1. Panduit Corp.
   2. American Labelmark Co.
   3. Markal Corp.
   4. Calpico, Inc.
   5. Ideal Industries, Inc.

2.2 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

B. Emergency Power panels and Equipment: Laminated three-layer plastic with engraved white letters on **RED** background.

C. Letter Size:
   1. 1/4 inch high letters for identifying individual equipment and loads.

D. Minimum nameplate thickness: 1/8 inch.

2.3 UNDERGROUND WARNING TAPE

A. Description: four (4) inch wide plastic tape, colored red with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
4. Secure nameplate to equipment front using screws, rivets, or adhesive.
5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
6. Install nameplates for the following:
    a. Switchboards
    b. Panelboards
    c. Transformers
    d. Service Disconnects
        1) Enclosed Switches
    e. Motor Control Centers
    f. Stand-alone Motor Controllers
    g. Generators
    h. Contactors

C. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable six (6) to eight (8) inches below finished grade, directly above buried conduit, raceway, or cable. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.
2. Install line marker for underground wiring, both direct buried and in raceway.

D. Printed Panelboard Directory:
1. Provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker for that panel, switchboard, or motor control center.
2. Panelboard directory shall include a legend indicating insulation color corresponding each phase and voltage in the building electrical system.
3. Copy in Owner’s Manual.

3.3 ABOVE CEILING JUNCTION BOXES

A. Labeling: Provide label on all above ceiling junction boxes.
   1. Provide permanent labeling with indelible black marker, in neat, legible print indicating the panelboard name, branch circuit number(s) and voltage of conductors within the junction box.

3.4 ARC FLASH WARNING LABEL

A. Switchboards, panel boards and motor control centers requiring examination, adjustments, servicing or maintenance while energized shall be field marked to warn persons of arc flash hazards. Marking shall be located so as to be clearly visible to qualified persons before servicing or maintenance.

END OF SECTION 26 05 53

SECTION 26 05 73.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard boundary distance and the incident energy to which personnel could be exposed during work on or near energized electrical equipment.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data: Submit information regarding computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals [**shall**] [**may**] be in digital form:

1. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
2. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
3. Exported data from computer-based, one-line diagram detailing the system data used for the arc-flash calculations, provided in .csv or Microsoft Excel format.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Power Systems Analysis Software Developer.
   2. For Power System Analysis Specialist.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Arc-Flash Hazard Analysis:
   1. Provide final arc-flash hazard analysis report in hard copy and digital format.
   2. Provide digital file containing electrical system model in a format consistent with power system analysis software used to perform study.
   3. Provide library files for power system analysis software used to perform study.

1.7 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. Computer program shall be designed to perform arc-flash analysis.

E. Power Systems Analysis Specialist Qualifications: Professional or qualified engineer in charge of performing the arc-flash study, analyzing the arc-flash results, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional or qualified engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide software developed and sold by EasyPower software with ANSI ShortCircuit, ArcFlash, PowerProtector, Scenario Manager, SmartDuty and SmartBreaker or comparable product by one of the following:
   1. CGI CYME.
   2. Power Analytics, Corporation.
   3. <**Insert manufacturer's name**>.

B. Software must provide results consistent with the requirements of the latest versions of IEEE 1584 and NFPA 70E.

C. Software capable of creation and storage of unlimited number of operating scenarios. All scenarios stored in the same project model file. System changes made to the base case automatically propagated to each operating scenario.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, indicating the following:
   1. Protective device designations, locations, and ampere ratings.
   2. Conductor types, sizes, and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator ratings.
   5. Switchgear, switchboard, motor-control center, and panelboard designations.
   6. Utility sources.

D. Study Input Data: As described in "Power System Data" Article.

E. Equipment Duty Report: As specified in Section 260573.13 "Short-Circuit Studies."

F. Data on all protective devices; manufacturers, types, sizes and adjustable settings that were used for the arc-flash calculations.

G. List of protective devices found to be inoperable or with signs of impending failure. These devices must be clearly listed and excluded from use in determination of the arc time.

H. Equipment Duty Study: Report to verify that all protective devices have adequate short-circuit ratings to interrupt the calculated maximum short-circuit current.

I. Arc-Flash Study Calculations and Output Reports:
   1. Arcing fault magnitude.
   2. Protective device clearing time.
   3. Duration of arc.
   4. Arc-flash boundary.
   5. Restricted approach boundary.
   6. Limited approach boundary.

7. Working distance.
8. Incident energy.

J. Arc-Flash Study input data, scenario descriptions, and arc-flash calculations including a definition of terms and guide for interpretation of the arc-flash hazard report. Study input data must be provided in electronic form as .csv or Excel files.

2.3 ARC-FLASH WARNING LABELS

A. Provide a weatherproof, self-adhesive equipment label for each location requiring arc-flash hazard identification.
1. Minimum Size: 6 inches (150 mm) wide by 4 inches (100 mm) high.
2. Sample label submitted for review prior to printing of actual labels.

B. Content: Orange header with the wording, "WARNING, ARC-FLASH HAZARD, Arc-Flash and Shock Risk Assessment, Appropriate PPE Required." and the following information taken directly from the arc-flash hazard analysis:
1. Equipment ID.
2. Nominal voltage.
3. Protection boundaries.
   a. Arc-flash boundary.
   b. Restricted approach boundary.
   c. Limited approach boundary.
4. Available incident energy.
5. Working distance.
6. Engineering report number, revision number, and issue date.

C. Completely machine printed, no field-applied markings.

D. Compliance: NFPA 70E.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project electrical equipment submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study. The report shall clearly state any assumptions that were necessary to complete the analysis.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with the latest versions of NFPA 70E for the arc-flash hazard analysis study.

B. Study all operating scenarios to determine the maximum incident energy at each location.

C. Submit proposed arc-flash analysis scenarios for review prior to performing arc-flash calculations. Arc-flash hazard analysis report shall indicate which scenario created the maximum arc-flash energy for each location. All arc-flash calculations must be performed in accordance with the procedures and recommendations contained in the latest version of IEEE 1584. Calculate the arc-flash hazard boundary and incident energy at all

locations in electrical distribution system where personnel could service or examine equipment while energized.

D. Include all three-phase medium- and low-voltage equipment locations.

E. Calculate the limited and restricted approach boundaries for each location.

F. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources or fault current that changes with time during the fault. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented based on the recommendations in IEEE 399 and ANSI C37 where applicable.

G. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
   1. When the circuit breaker is in a separate enclosure.
   2. When the line terminals of the circuit breaker are separate from the work location.

H. Base arc-flash calculations on the time-current curve or operating time of the fastest upstream device using the predicted arcing current through that device. For medium-voltage circuit breakers, the breaker interrupting time must be automatically added to the relay operating time. Based on the recommendations in IEEE 1584 and sound engineering judgment, a maximum arc time of two seconds can be applied for situations where the protective device operating time is found to exceed two seconds.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.
   1. Verify completeness of data supplied on one-line diagram on Drawings. Call any discrepancies or missing information to Owner's attention.
   2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
   3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer. Data shall include, but are not limited to, the following:
   1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Obtain electrical power utility impedance or available short-circuit current at each service.
   3. Short-circuit current at each system bus (three phase and line to ground).
   4. Voltage level at each bus.
   5. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio if available, tap settings, and phase shift.

6. For reactors, provide manufacturer and model designation, voltage rating and impedance.
7. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, short-circuit rating, continuous current rating, and settings for all adjustable settings.
8. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
9. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
10. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
11. Motor horsepower.
12. Low-voltage conductor sizes, lengths, number, conductor material, and conduit material.
13. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material.

3.4 LABELING

A. Apply [**one**]arc-flash label on the front cover [**of each section of the equipment**] [**and on side or rear covers with accessible live parts and hinged doors or removable plates**] for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:
1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Low voltage transformers.
6. Panelboard.
7. Safety switch.
8. Fused disconnect switch.
9. Enclosed circuit breaker.
10. Adjustable frequency drive.
11. Control panel.
12. <**Insert any other equipment that could be serviced or examined while energized**>.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the interpretation of arc-flash warning labels.

END OF SECTION 26 05 73.19

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 26.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the owner will manage the commissioning process.

1.3 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

1.4 SUMMARY

A. This Section includes requirements for commissioning the Facility electrical systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.5 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.6 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 26 is part of the construction process. Documentation and testing of these systems, as well as training of the OWNER’s Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 26, is required in cooperation with the OWNER and the Commissioning Agent.

B. The Facility electrical systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.7 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the OWNER prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of Electrical systems will require inspection of individual elements of the electrical systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule electrical systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the OWNER and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 26 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.4 TRAINING OF OWNER PERSONNEL

A. Training of the OWNER operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the OWNER Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 26 Sections for additional Contractor training requirements.

END OF SECTION 26 08 00

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes enclosed contactors for lighting and general purposes. Provide complete systems using contactors, relays, photocells, time clocks, or digital time switches, where required, all properly mounted in enclosures.

1.3 SUBMITTALS

A. Product Data: Submit dimensions, size, voltage ratings and current ratings.

B. Short circuit current rating (SCCR) of equipment.

C. U.L. Label.

D. Electrical characteristics of equipment.

E. Enclosure metal gauge and finish.

1.4 CLOSEOUT SUBMITTALS

A. Provide manuals as described in Section 26 05 00.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE CONTACTORS

A. General: Provide contactors and relays with ratings as indicated or as required to operate the installed load at the applied voltage using the applied contact voltage. Contactor shall be rated for making and breaking motor or other inductive loads.

B. Manufacturers:
1. ASCO
2. Square D
3. GE

C. Enclosure: Provide a NEMA 1 enclosure for all contactors located indoors. Provide NEMA 4X for those located outdoors and in wet areas.

D. Lighting Contactors:
1. Mechanically held, electrically operated.
2. ASCO 918 or approved equal.
3. Provide ASCO Accessory 47 for two-wire control of contactor. Provide time switch and photocell to control contactor.

4. Some lighting contactors may be designated for control by Division 23 Building Automation System (BAS). Provide contactor and ASCO solid-state Accessory 47 for two-wire control of contactor. Division 23 shall provide all BAS control wiring. BAS provides all time-of-day ON/OFF scheduling.
5. Three-phase Contactors: When lighting contactors are indicated to control an entire panel or sub-panel, provide ASCO 920 or approved equal. Include two-wire control relay ASCO Accessory 47.
6. Parking Lot, Exterior Lighting and Sport Lighting Contactors: Provide 3-phase, 3-pole ASCO 920 contactors as indicated on Drawings. Include two-wire control relay ASCO Accessory 47. Also provide solid state control module and housing with Hand-off-Auto selector switch. All contactors that control any branch circuit that serves any lighting fixtures or entire panels that feed outdoor lighting shall be provided with the HOA control feature.

E. SCCR: Contactor shall have short circuit current rating established by actual testing with specific overcurrent protection device. SCCR shall be UL-listed.

2.2 PHOTO-ELECTRIC CONTROLS:

A. Description:
1. General: Photo-electric control shall switch load ON at dusk and OFF at dawn.
2. Housing: Photocell shall be enclosed in a weatherproof, corrosion resistant housing. The housing shall have a 1/2 inch I.P.S. nipple with a locking washer.
3. Element: Light sensing element shall be Cadmium-Sulfide cell hermetically sealed against moisture. Minimum time delay before change-of-state shall be 15 seconds. If the photo-electric control fails, the load shall switch ON (fail-safe ON).
4. Adjustment: The housing shall have an adjustable slide shield to vary the ambient light reaching the CdS cell. The slide shield shall not override the control; that is, the ON/OFF function shall occur even when the shield is at either extreme of the adjustment range. Adjustment shall be made by hand without tools.
5. Temperature: The photocell shall be suitable for operation in an ambient temperature range of -30 degrees Fahrenheit to + 140 degrees Fahrenheit.
6. Voltage: The photocell shall be suitable for use at voltage equal to the load voltage (120, 208, 277).
7. Capacity: Photocell shall be SPST rated for a minimum of 1800 Volt-Amps resistive or inductive load.
8. Leads: Photocell shall have minimum six (6) inch wire leads with wet location insulation. Leads shall be color coded Red/Load, Black/Line and White/Neutral.
9. Listing: Photocell shall be listed by Underwriters Laboratories.

B. Manufacturer: Intermatic, Paragon, Precision, Tork.

2.3 TIME CLOCKS:

A. Manufacturer:
1. Grasslin
2. Intermatic
3. Paragon
4. Precision
5. Tork

B. General: Provide time clocks similar to Intermatic Series T 1900 or Tork B8000 Series. Provide wiring to photocells, contactors, relays or other control points as required.

C. Contacts: Rated for 20 amps minimum at 277 volts. Provide 1, 2, 3 or 4 pole, single or double throw, maintained or momentary contact, as required based on the time clock function and the number of branch circuits controlled. Contacts shall be horse power rated when motors are switched.

D. Dial: Provide 24-hour dial with 15 minute intervals minimum. Dial shall permit at least 48 ON/OFF cycles per day via 96 adjustable tabs. Dial shall include a skip-a-day wheel and two day-omitting pins. Provide extra trippers and day-omitting pins if required.

E. Special Dials: Provide special dial where indicated on drawings or in these specifications. Provide astronomic dial for time clock controlling outdoor lighting.

F. Timing Motor: Provide heavy duty synchronous timing motor, self-starting and permanently lubricated. Motor shall be permanent magnet type for high torque and operate through and ambient temperature range of - 30 degrees Fahrenheit to + 130 degrees Fahrenheit. Motor cover shall have a viewing window to check for rotation of gears. Motor voltage shall be 120, 208, 240 or 277 volts as required.

G. Reserve Power: Provide a spring driven reserve power drive to operate time clock for at least ten (10) hours after a power failure.

H. Manual Bypass:
1. Time clock shall include a manual ON/OFF bypass switch capable of overriding time schedule without disturbing trippers or timing sequence.
2. Time clock shall be installed with a pilot-light SPST toggle switch mounted in a separate, adjacent single-gang box. Switch shall be labelled "Bypass" and shall function to turn ON circuit(s) controlled by the time clock. Switch shall be flush or surface mounted to match time clock housing.

I. Terminals: Time clock shall have a terminal block with screws for line, load, and grounding connections with up to AWG #8 wire. Provide a removable dead-front terminal cover within the time clock case. Timing motor shall have separate, unswitched terminals.

J. Enclosure: Provide a NEMA 1 enclosure with hasp suitable for padlock and side-hinge door for all clocks located indoors. Enclosure shall have 1/2 inch and 3/4 inch knockouts in bottom and sides. Provide NEMA 4X for those located outdoors and in wet areas.

K. Nametag: Provide a nametag for each time clock stating load controlled; see Section 26 05 53, Electrical Identification.

L. Listing: All time clocks shall be listed by Underwriters Laboratories and C.S.A.

M. Manuals: Provide three sets, each consisting of operating instructions and one-line diagrams.

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Specifier's Note: Edit for each Job.
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2.4 DIGITAL TIME SWITCHES:

A. Recessed in wall: WattStopper TS-400 or approved equal.

1. The digital time switch shall be programmable to turn lights off after a preset time.

2. Time switch shall be a completely self-contained control system that replaces the standard toggle switch. It shall have a ground wire and ground strap for safety. Switching mechanism shall be a latching air gap relay.

3. Zero Crossing Circuitry shall be used to increase the relay life, protect from the effects of inrush current, and increase the switch's longevity.
4. Time switch shall be compatible with all electronic ballasts, motor loads, compact fluorescent and inductive loads. Triac and other harmonic generating devices shall not be allowed.
5. Time switch shall operate at universal voltages of 100-300 VAC; 50/60 Hz.
6. Time switch shall have no minimum load requirement and shall be capable of controlling 0 to 800 watt incandescent, fluorescent @ 100/120 VAC, 50/60 Hz; 0 to 1200 watts fluorescent @ 230/277 VAC, 50/60 Hz; 1/6 hp @ 125 VAC.
7. Time scroll feature shall allow manual overriding of the preset time-out period. Selecting time scroll UP shall allow time-out period to scroll up throughout the timer possibilities to the maximum. Time scroll DN (down) shall allow time-out period to scroll down to minimum.
8. Time switch shall have the option for a one second light flash warning at five minutes before the timer runs out and twice when the countdown reaches one minute (when used to control lighting loads).
9. Time switch shall have the option for a beep warning that shall sound every five seconds once the time switch countdown reaches one minute.
10. Time switch shall have manual feature for timer reset where pressing the ON/OFF switch for more than 2 seconds resets the timer to the programmed time-out period.
11. Time switch shall have an electroluminescent backlit Liquid Crystal Display that shows the timer's countdown.
12. Time switch shall fit behind a decorator style faceplate. The calibration switch for setting time-out, time scroll, one second light flash, and beep warning shall be concealed to prevent tampering of adjustments and hardware.
13. Time-out period shall be adjustable in increments of 5 minutes from 5 minutes to 1 hour, and in increments of 15 minutes from 1 hour to 12 hours.
14. Time switch shall be capable of operating as an ON/OFF switch.
15. For ease of installation and cleaner wiring, the switch shall utilize terminal style wiring.
16. The time switch shall not protrude more than 1/8" from the wall and should blend in aesthetically.
17. For safety, the time switch shall have a 100% OFF override switch with no leakage current to the load.
18. For safety, in the event there is an open circuit in the AC line such as a ballast or lamp failure, the time switch shall automatically switch to OFF mode.
19. To ensure quality and reliability, time switch shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
20. Time switch shall have 5 year warranty and shall be UL and CUL listed.

2.5 OCCUPANCY SENSORS:

A. Ceiling Sensors: Require power packs
   1. UT-3000-3- Low voltage ultrasonic ceiling mounted with 2000 square foot coverage. Typical for large restroom.
      DT-300- Low Voltage dual technology ceiling mounted with isolated contact. Typical for classrooms.
   2. WT-2250/2255- Typical corridor sensor- Low voltage ultrasonic ceiling mounted with 10' by 90' coverage pattern

B. Wall Switch Sensors:

DSW-301- Line voltage dual technology wall switch sensor for 1 circuit. Typical for large office or conference room.
DW-100-24- Low voltage dual technology wall switch sensor. Requires Power Pack
DSW-302- Line voltage dual technology wall switch sensor for 2 circuits
DW-311 – Line voltage dual technology wall switch sensor with 0-10V dimming

1. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
2. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180˚ coverage capability.
3. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
4. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
5. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
6. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.

C. Power and Auxiliary Packs:

1. BZ-150- Power pack for use with low voltage sensors when using a manual on function. 225ma

D. High Ceiling Applications

1. HB-350B*LENS Low Voltage PIR sensor
2. L1 Lens- 20' x 60' coverage pattern when mounted at 40'
3. L3 Lens- 40' diameter coverage pattern when mounted at 40'
4. L4 Lens- 60' diameter coverage pattern when mounted at 60'

E. Passive infrared sensors:

1. Passive infrared sensors shall utilize Pulse Count Processing and Detection Signature Processing to respond only to those signals caused by human motion.
2. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).
3. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
4. Where specified, passive infrared ultrasonic and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

F. Dual technology sensors:

1. Dual technology sensors shall be wall mounted, corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas.
2. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

G. Ultrasonic sensors:

1. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
2. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002%

tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

H. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

I. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

J. When specified, sensors shall utilize SmartSet™ technology for automatically adjustable time delay and sensitivity settings.

K. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

L. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

M. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

N. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

O. All sensors shall have UL rated, 94V-0 plastic enclosures.

P. All occupancy sensors shall be set to maximum 30 minute time delay.

Q. Provide minimum 5% spare sensors for owner stock of each type of occupancy sensor.

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Specifier's Note: Edit for each Job.
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2.6 DAYLIGHT HARVESTING – Wattstopper LightSaver® LS-301 Daylighting Sensor

A. The photosensor shall be a self-contained, ceiling-mounted daylighting control device that detects changes in light levels and raises or lowers electrical lighting in response.

B. The photosensor shall be a low voltage device, powered by 24 VDC voltage supplied by a power pack.

C. The photocell shall have an extremely linear response with greater than 1% accuracy over the sensed range.

D. The photosensor shall be capable of controlling up to 50 standard 0-10VDC electronic dimming ballasts.

E. The photosensor shall utilize an internal photocell that measures only in the visible

spectrum and has a response curve that closely matches the photopic curve. The photocell shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.

F. The photosensor shall provide dimming over the full range from .2 VDC to 10 VDC. When maximum dimming is required, a .2 volt output is supplied to the ballast; when full output lighting is required, a 10 volt output is supplied to the ballast.

G. The photosensor shall use a sliding setpoint algorithm. The photosensor shall maintain the desired task level illuminance for current daylight contribution based on two setpoints, a night setpoint and a day setpoint.

H. All setup adjustments shall be made remotely from the photosensor by means of a wireless, infrared handheld remote. All setup adjustments shall be done from the ground with no ladders required after the initial installation has been completed.

I. The photosensor shall be controllable by a compatible handheld remote that allows an occupant to adjust the light level to their preference while enabling the automatic dimming to continue to achieve the adjusted setpoint. Any adjustment made with the handheld remote shall be easily canceled by pressing one button on the remote.

J. The photosensor shall have a control range of 20-60 footcandles.

K. The photosensor shall not protrude more than 0.75 inches from the ceiling and should blend in aesthetically.

L. To ensure quality and reliability, photosensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

M. The photosensor shall have a standard five year warranty.

2.7 SPORTS LIGHTING CONTROL STATION

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Specifier's Note: Edit for each Job.
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A. General: Provide pushbuttons for manual override of programmable relays designated to control the power contactors for the outdoor sports lighting at each field. Arrange pushbuttons into a single enclosure for each field.

B. Enclosure: Enclosure shall be NEMA 4X stainless steel or polycarbonate with gasketing for outdoor wet locations.

C. Pushbutton: Similar to Square D Class 9001-Type B, Type BW245, NEMA 4, momentary contact, RED/ON and GREEN/OFF pushbuttons with collar guard.

D. Wiring: From each pushbutton in the Sports Lighting Control Station, provide low voltage wiring to the programmable relay cabinet.

E. Control: BAS schedules all power contactors for outdoor sports lighting via the programmable relay system. Each sports field shall have a programmable relay assigned to the contactors for the sports lighting of that field. BAS will program automatic schedules

for the sports lighting as required. User shall be able to override automatic schedule from BAS with manual ON/OFF signals from the pushbutton Lighting Control Stations. Pushbutton signals relay cabinet, similar to a classroom light switch, and relay causes the lighting contactors to change state (OFF to ON, ON to OFF).

F. Engraving: Provide engraved lamacore plate above each pushbutton describing the lighting it will control. Example: TENNIS COURTS; FOOTBALL-EAST POLES, FOOTBALL-WEST POLES, BASEBALL, SOFTBALL.

G. Relays: For each pushbutton control, provide a relay in the local relay cabinet nearest the sports lighting contactors. Wire relay to the control circuits of the associated sports lighting contactors. Program BAS for both automatic scheduling of the sports lighting and to accept manual override from pushbutton Sports Lighting Control Stations.

PART 3 - EXECUTION

3.1 PHOTO-ELECTRIC CONTROL MOUNTING:

A. Provide photo-electric control on roof of building. When more than one building is constructed on site, install photo control on each roof. Aim true North and locate in places where ambient night lighting will not cause interference. Wire down to respective contactors in each building.

3.2 TIME CLOCK PROGRAMMING:

A. Install time clock and photocell for ON by photocell at dusk, OFF by time clock at midnight, then ON by time clock at 5:00 a.m. and OFF by photocell at dawn. Program time clock ON/OFF times to other time(s) when indicated on Drawings.

3.3 INSTALLATION

A. Install enclosed contactors (as indicated on Drawings), in accordance with NECA "Standard of Installation".

B. Install engraved nameplates. Refer to Section 26 05 53 for requirements.

C. Install contactor and relays in Electrical / Mechanical Rooms unless otherwise noted.

END OF SECTION 26 09 23

SECTION 26 09 43 - DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Distributed Digital Lighting Control System: System includes
   1. Digital Lighting and Plug Load Controls
   2. Relay Panels
   3. Emergency Lighting Control.

1.2 RELATED SECTIONS

A. Section 27 05 39 - Surface Raceways for Communications Systems

B. Section 26 50 00 - Lighting.

C. Section 26 52 00 - Emergency Lighting.

D. Section 25 55 00 - Integrated Automation Control of HVAC- Integrated Automation, Building integrator shall provide integration of the lighting control system occupancy sensors with Building Automation Systems.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. NEMA - National Electrical Manufacturers Association

C. FCC emission standards

D. UL - Underwriters Laboratories, Inc. Listings

E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

F. UL 20 - General Use Switches, Plug Load Controls

G. UL 924 - Standard for Emergency Lighting and Power Equipment

H. ULC - Underwriter Laboratories of Canada Listings

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Lighting Control System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, plug load controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

B. System shall conform to requirements of NFPA 70.

C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Catalog sheets and specifications.
   2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   3. Storage and handling requirements and recommendations.
   4. Installation instructions.

C. Shop Drawings: Wiring diagrams for the various components of the System specified including:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
   3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
   4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals:
   1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
   2. Operation and Maintenance Manual:
      a. Include approved Shop Drawings and Product Data.
      b. Include Sequence of Operation, identifying operation for each room or space.
      c. Include manufacturer's maintenance information.
      d. Operation and Maintenance Data: Include detailed information on device programming and setup.
      e. Include startup and test reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:
   1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
   2. Review the specifications for low voltage control wiring and termination.
   3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
   4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:
   1. Record minutes of the conference and provide copies to all parties present.

2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
2. Relative humidity: Maximum 90 percent, non-condensing.

1.10 WARRANTY

A. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

1.11 MAINTENANCE

A. Spare Parts:
1. Provide 5% spares of each product listed below to be used for maintenance. Electrical Contractor shall deliver items to Owner within 30 days of substantial completion.
a. Room Controllers
b. Occupancy Sensors
c. Emergency Bypass controllers
d. Low voltage switches
e. Daylighting harvesting photocells

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturer: WattStopper (basis of design), Acuity

B. Substitutions must meet performance requirements of this section 26 09 43.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

A. System General: Provide a Distributed Lighting Control System complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between

the Drawing and this Specification, contact the Architect for clarification prior to proceeding.

1. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
    a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
    b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
    c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
    d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
2. Digital Room Controllers and Plug Load Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
3. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with two-way active infrared (IR) communications.
4. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
5. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
6. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
7. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter.
8. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-native digital networked communication between other lighting relay panels and/or building automation system (BAS).
9. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
1. Features of the DLM local network include:
    a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
   a. Data transmission
   b. Device has power
   c. Status for each load
   d. Configuration status
5. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
   a. Turn on to 100 percent
   b. Turn off
   c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-off (Follow on and off)
   b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
   a. Load status
   b. Schedule state, normal or after-hours
   c. Demand Response enable and disable

d. Room occupancy status
e. Total room lighting and plug loads watts
f. Electrical current
g. Total watts per controller
h. Total room watts/sq ft.
i. Force on/off all loads

10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
    a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    c. The following dimming attributes may be changed or selected using a wireless configuration tool:
        1) Establish preset level for each load from 0-100 percent
        2) Set high and low trim for each load
        3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
    d. Override button for each load provides the following functions:
        1) Press and release for on/off control
        2) Press and hold for dimming control
    e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
    f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
    g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
    h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

B. On/Off Room Controllers and Plug Load Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
2. One or two relay configuration
3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
5. WattStopper product numbers: LMRC-101, LMRC-102, LMPL-101, LMPL-111-20M

C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
2. Optional real time current and voltage monitoring (with - M Monitoring option).
3. One or two relays configurations
4. Smart 150 mA switching power supply
5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
6. One dimming output per relay

a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting

7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Digital Occupancy Sensors features shall include the following:
   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity, 0-100 percent in 10 percent increments
      b. Time delay, 1-30 minutes in 1 minute increments
      c. Test mode, Five second time delay
      d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
      e. Walk-through mode
   2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   3. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
      d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      e. Ultrasonic and Passive Infrared
      f. Ultrasonic or Passive Infrared
      g. Ultrasonic only
      h. Passive Infrared only
      i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
   4. One or two RJ-45 port(s) for connection to DLM local network.
   5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
   6. Device Status LEDs, which may be disabled for selected applications, including:
      a. PIR detection
      b. Ultrasonic detection
      c. Configuration mode
      d. Load binding
   7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
   8. Manual override of controlled loads.
   9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

B. Units shall not have any dip switches or potentiometers for field settings

C. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

D. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 Wired Low Voltage Isolated Relay Interface:

1. Module provides a single Form C contact relay rated for 24VAC or VDC.
2. Relay module will provide a contact closure on the Normally Open side of the relay (and contact open on the Normally Closed side) while any occupancy sensor on the local Cat 5e IRB network is in the occupied mode. This function is non-programmable and works automatically using the unit's internal circuitry.
3. LED on the device to provide status of the relay
4. This device is ideally suited to connect to HVAC inputs in the space that are looking for a dry contact whenever the space is occupied to enhance their specific sequence of operation.
5. Wattstopper product number LMRL-100

2.6 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in multiple button configurations. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   3. Configuration LED on each switch that blinks to indicate data transmission.
   4. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
      d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
   5. Programmable control functionality including:
      a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
      b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
   6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

D. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.
   3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   4. Ramp rate may be adjusted for each dimmer switch.
   5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

6. WattStopper product numbers: LMSW-210, LMSW-211, LMSW-220, LMSW-222, LMSW-241, LMSW-250. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.7 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
   1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
   2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
   3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone

B. Digital daylighting sensors shall include the following features:
   1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
   2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
   3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
   4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
   5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
   6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
   7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
   8. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
   9. Configuration LED status light on device that blinks to indicate data transmission.
   10. Status LED indicates test mode, override mode and load binding.
   11. Recessed switch on device to turn controlled load(s) ON and OFF.
   12. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
      a. Light level
      b. Day and night setpoints
      c. Off time delay
      d. On and off setpoints
      e. Up to three zone setpoints
      f. Operating mode - on/off, bi-level, tri-level or dimming
   13. One RJ-45 port for connection to DLM local network.
   14. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate

mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

15. Any load or group of loads in the room can be assigned to a daylighting zone
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
17. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:
   1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
   2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
   3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
   4. WattStopper Product Number: LMLS-400.

D. Open loop digital photosensors shall include the following additional features:
   1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
   2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
   3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
   4. WattStopper Product Number: LMLS-500.

2.8 DIGITAL PARTITION CONTROLS

A. Partition controls shall enable automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.

B. Infrared partition sensor to detect state of movable partitions shall automatically alter functionality of switches and sensors in a room .
   1. Operates on Class 2 power supplied by DLM local network.
   2. Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
   3. Input max. sink/source current: 1-5mA
   4. Logic input signal voltage High: > 18VDC
   5. Logic input signal voltage Low: < 2VDC
   6. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
   7. Two RJ-45 ports for connection to DLM local network.
   8. WattStopper part number: PARTITION-SENSOR; LMIN-104

2.9 HANDHELD CONFIGURATION TOOLS

A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
   1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
   2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
   3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
   4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
   5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
   6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
   7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
   8. Verify status of building level network devices.

C. WattStopper Product Numbers: Handheld LMCT-100

2.10 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:
   1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
   2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
   3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:
      a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
      b. Individual terminal block, override pushbutton, and LED status light for each relay.
      c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
      d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
      e. True relay state shall be indicated by the on-board LED and shall be available

to external control devices and systems via BACnet.

f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.

g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.

h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   a. Electrical:
      1) 30 amp ballast at 277V
      2) 20 amp ballast at 347V
      3) 20amp tungsten at 120V
      4) 30 amp resistive at 347V
      5) 1.5 HP motor at 120V
      6) 14,000 amp short circuit current rating (SCCR) at 347V
      7) Relays shall be specifically UL 20 listed for control of plug-loads
   b. Mechanical:
      1) Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
      2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
      3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
      4) Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic bypass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 networked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
   c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
   d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-

configured control scenarios. Scenarios shall include:
1) Scheduled ON / OFF
2) Manual ON / Scheduled OFF
3) Astro ON / OFF (or Photo ON / OFF)
4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
    a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
    b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
    c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
    d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
    e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
    f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
        1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
        2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
        3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
        4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
    g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)
i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
    a. Use the same intelligence board as the LMCP relay panel.
    b. Shall not include relay driver boards or relays.
    c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
    d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
    e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

B. User Interface: Each lighting control panel system shall be supplied with one handheld configuration tool. As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
    1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
    2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
    3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
    4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.

5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. WattStopper Product Number: LMCT-100

2.11 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter.

B. Additional parameters exposed through this method include but are not limited to:
1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1. Device list report: All devices in a project listed by type.
2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
1. Set, copy/paste an entire project site of sensor time delays.
2. Set, copy/paste an entire project site of sensor sensitivity settings.

3. Search based on room name and text labels.
4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
5. Filter by parameter value to search for product with specific configurations.

E. WattStopper Product Number: LMCS-100, LMCI-100

2.12 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

C. Generator Transfer Device – For areas noted on plans that require a UL1008 device, provide Bodine GTD20A device.

PART 3 EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
3. Low voltage wiring topology must comply with manufacturer's specifications.
4. Document all device locations and wiring on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
   1. Verify Class I and II wiring connections are terminated properly by validating system performance.
   2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
   3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
   4. Verify that the control of each space complies with the Sequence of Operation.
   5. Correct any system issues and retest..

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
   1. Date of test or inspection.
   2. Loads per space, or Fixture Address identification.
   3. Quantity and Type of each device installed
   4. Reports providing each device's settings.

3.4 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The factory commissioning shall include the following services. Programming of all button stations, configuration of all occupancy sensors and photocells. Verification of a complete and working system including MSTP network status. Provide written or computer-generated

documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

C. The electrical contractor shall request factory commissioning by submitting a startup request form at least (4) weeks before startup is required.

D. Electrical contractor must schedule lighting control factory start-up to begin at least 60 days prior to substantial completion deadline.

E. Lighting control technician shall issue daily reports notifying of the project status, open issues, challenges, etc. at the end of each day he/ she is onsite commissioning the system. Reports shall be sent directly to EC, GC and Engineer.

F. At the completion of the first visit of the lighting control technician, all parties shall meet onsite to walk the project and evaluate any open issues. At this meeting the schedule for owner training shall be determined.

G. The electrical contractor shall provide at least (1) journeyman electrician, familiar with the installation of the system, dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.

H. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

I. Re-commissioning – After 90 days from occupancy the factory authorized representative and electrical contractor shall re-calibrate all sensor time delays and sensitivities to meet the Owner’s Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity

J. Owner operation memo- Lighting control manufacturer shall prepare an operational memo for owner to distribute informing building occupants of the operation of their lighting control system. Memo shall explain the following but not limited to: auto on/ vs manual on, occupancy sensors, daylight harvesting, plug load control, after hours time delays.

END OF SECTION 26 09 43

SECTION 26 09 43 – NETWORKED DIGITAL LIGHTING CONTROLS
(THIS SPECIFICATION SECTION SHALL BE PRICED AS AN ALTERNATE)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Digital Occupancy and Daylighting Sensor Control
2. Emergency Lighting Control

B. Related Section
1. Section [260926 – Lighting Control Panel Boards:] Lighting panels (switching) controlled by Digital Network Lighting Control System.
2. Section [260936 – Modular Dimming Controls:] Digital Lighting Management
3. Section [262726 - Wiring Devices:] Receptacles
4. Section [265113 – Interior Lighting Fixtures, Lamps, and Ballasts:] Fluorescent electronic dimming ballasts.
5. Section [25000 – Integrated Automation] Building integrator shall provide integration of the lighting control system with Building Automation Systems.
6. Drawings and general provision of the Contact, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section
7. Electrical Sections, including wiring devices, apply to the work of this Section.

C. Control Intent – Control Intent includes, but is not limited to:
1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
2. Initial sensor and switching zones
3. Initial time switch settings
4. Task lighting and receptacle controls
5. Emergency Lighting control

1.3 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

B. Underwriter Laboratories of Canada (ULC)

C. International Electrotechnical Commission

D. International Organization for Standardization (ISO)

E. National Electrical Manufacturers Association (NEMA)

F. WD1 (R2005) - General Color Requirements for Wiring Devices.

G. Underwriters Laboratories, Inc. (UL)
1. 916 – Energy Management Equipment.

2. 924 – Emergency Lighting

1.4 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:
   1. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relays controllers with **integral current thyristor**, 0-10 volt control for ballasts.
   2. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   3. Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
   4. Digital Photosensors – Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.
   5. Configuration Tools – Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings. Computer software also customizes room settings.
   6. Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.
   7. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
   8. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS).
   9. Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
   10. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

1.5 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

B. Shop Drawings:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
   2. Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:
   1. Indicates where sensor is proposed to be installed.
   2. Prove that the sensor is suitable for the proposed application.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum [10] years' experience in manufacture of lighting controls. Provide list of (5) projects that have been complete for more than (1) year within 100 miles of new project location.

1.7 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0° to 40° C (32° to 104° F).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.8 WARRANTY

A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

1.9 MAINTENANCE

A. Spare Parts:
   1. Provide 5% spares of each product listed below to be used for maintenance. Electrical Contractor shall deliver items to Owner within 30 days of substantial completion.
      a. Room Controllers
      b. Occupancy Sensors
      c. Emergency Bypass controllers
      d. Low voltage switches
      e. Daylighting harvesting photocells

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:
   1. WattStopper (basis of design)
   2. Acuity

2.2 SINGLE / DUAL RELAY WALL SWITCH OCCUPANCY SENSORS

A. Type PW: Manual-ON, Automatic-OFF passive infrared (PIR) wall switch occupancy sensor Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled; WattStopper PW-100, PW-200, PW-103, PW-203, PW-301, PW-302, WS-301.

B. Type UW: Manual-ON, Automatic-OFF ultrasonic wall switch occupancy sensor with Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled; WattStopper UW-100, UW-200.

C. Type DW: Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each

area (and type of lighting) controlled; WattStopper DW-100, DW-200, DW-103, DW-203, DW-311, DSW-100, DSW-200, DW-103, DW-203, DSW-301, DSW-302.

2.3 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters. Passive infrared only sensors shall not be used for classroom applications.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton programming for the following variables:
      a. Sensitivity – 0-100% in 10% increments
      b. Time delay – 1-30 minutes in 1 minute increments
      c. Test mode – Five second time delay
      d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
      e. Walk-through mode
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   2. One or two RJ-45 port(s) for connection to DLM local network.
   3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
   4. Device Status LEDs including:
      a. PIR Detection
      b. Ultrasonic detection
      c. Configuration mode
      d. Load binding
   5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
   6. Manual override of controlled loads.

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. All devices shall be hard wired. No wireless devices shall be permitted.

F. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.4 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in multiple button configuration; available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttors and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   3. Red configuration LED on each switch that blinks to indicate data transmission.
   4. Blue Load/Scene Status LED on each switch button with the following characteristics:

a. Bi-level LED
b. Dim locator level indicates power to switch
c. Bright status level indicates that load or scene is active

5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

D. The following switch attributes may be changed or selected using a wireless configuration tool:
1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2. Individual button function may be configured to Toggle, On only or Off only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.
6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

E. WattStopper product numbers: LMSW-210, LMSW-211, LMSW-220, LMSW-222, LMSW-241, LMSW-250

2.5 ROOM CONTROLLERS

A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
3. Device Status LEDs to indicate:
a. Data transmission
b. Device has power
c. Status for each load
d. Configuration status
4. Quick installation features including:
a. Standard junction box mounting
b. Quick low voltage connections using standard RJ-45 patch cable
5. Plenum rated UL 2043
6. Manual override and LED indication for each load
7. Dual voltage (120/277 VAC, 60 Hz)
8. Zero cross circuitry for each load.

B. On/Off/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
2. One, two or three relay configuration
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports.

5. One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
2. The following dimming attributes may be changed or selected using a wireless configuration tool:
   a. Establish preset level for each load from 0-100%
   b. Set high and low trim for each load
   c. Set lamp burn in time for each load up to 100 hours
6. WattStopper product numbers: LMRC-111, LMRC-112, LMRC-211, LRMC-212, LRMC-213

2.6 DIGITAL PHOTOSENSORS

A. Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.

B. Digital photosensors include the following features:
1. An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-10,000 footcandles (fc).
3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
6. Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.
7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
8. Red configuration LED that blinks to indicate data transmission.
9. Blue status LED indicates test mode, override mode and load binding.
10. Recessed switch to turn controlled load(s) ON and OFF.
11. One RJ-45 port for connection to DLM local network.
12. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.

C. Closed loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes setpoints following self-calibration.

4. A sliding setpoint control algorithm for dimming daylight harvesting with a “Day Setpoint” and the “Night Setpoint” to prevent the lights from cycling.
5. WattStopper Product Number: LMLS-400.

D. Open loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.
3. A proportional control algorithm for dimming daylight harvesting with a “Setpoint” to be maintained during operation.
4. WattStopper Product Number: LMLS-500.

2.7 EMERGENCY LIGHTING

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz., 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

C. Generator Transfer Device – For corridors and other areas noted on plans that require a UL1008 device, provide Bodine GTD20A device.

2.8 ROOM NETWORK (DLM Local Network)

A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:
1. Plug n’ Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
3. Push n’ Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.09 LIGHTING CONTROL PANELS

A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:
1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 – 8 relays, 1 – 24 relays and 6 four-pole contactors, or 1 – 48 relays and 6 four-pole contactors.

2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
    a. Removable, plug-in terminal blocks with screwless connections for all low voltage terminations.
    b. Individual terminal block, override pushbutton, and LED status light for each relay.
    c. Direct wired switch inputs associated with each relay and group channel shall support two-wire, momentary or maintained contact switches.
    d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches, digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs, digital IO modules capable of receiving momentary or maintained contact closure inputs, digital photocell modules, and digital occupancy sensors.
    e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
    f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
    g. Group, channel, and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override pushbuttons and LED displays for channels 1-9 or a handheld IR programmer for channels 1-99.
    h. Relay group status for each channel shall be provided through red LED indicators for groups 1-9 and via BACnet for groups 1-99. Solid red indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
    i. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
        1) Electrical:
            (a) 30 amp ballast at 277V
            (b) 20 amp ballast at 347V
            (c) 20 amp tungsten at 120V
            (d) 30 amp resistive at 347V
            (e) 1.5 HP motor at 120V
            (f) 14,000 amp short circuit current rating (SCCR) at 347V
            (g) Relays shall be specifically UL listed for control of plug loads
        2) Mechanical:
            (a) Individually replaceable, ½" KO mounting with removable Class 2 wire harness.
            (b) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
            (c) Dual line and load terminals each support two #14 – #12 solid or stranded conductors.
            (d) Tested to 300,000 mechanical on/off cycles.
        3) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.

4. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

5. Lighting control panels shall be WattStopper model LMCP8, LMCP24 or LMCP48 as shown on the plans.

2.10 BACnet® BASED DIGITAL COMMUNICATIONS

A. The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 master/slave token passing-based using the BACnet® protocol.
   1. The panel shall have provision for an individual BACnet device ID. The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
   2. The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
   3. Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
   4. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64.
   5. The 99 channel groups associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
   6. Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
      a. Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays.
      b. Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control.
      c. Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays.
      d. Analog value objects in the instance range of 1 – 64 (one per relay) shall assign relays to channel groups in the range of 1 – 99.
      e. Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute gracetime period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
      f. Analog value objects in the instance range of 201 – 299 (one per channel) shall assign an after hours time delay value to the channel in the range of 1 – 240 minutes.
      g. Multi-state value objects in the instance range of 1 – 99 (one per channel) shall provide the state of the relays assigned to the channel. Valid states shall be ALL ON, MIXED, BLINK, and ALL OFF.
   7. The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

8. The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)
9. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
10. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.
11. Lighting control accessory devices connected to the panel shall be represented via BACnet objects including but not limited to the following:
    a. Digital occupancy sensor detection states shall be readable as BI objects ranging from BI1-96.
    b. Digital occupancy sensor configuration parameters shall each be accessible as BACnet objects when applicable to a given product.
        (1) Occupancy sensor time delay in minutes shall be writeable via AV101-196.
        (2) Occupancy sensor passive infrared (PIR) sensitivity percentage shall be writeable via AV201-296.
        (3) Occupancy sensor ultrasonic (US) sensitivity percentage shall be writeable via AV301-396.
    c. Digital switch buttons shall be readable and writeable as BI objects ranging from BI101 – 9608.
    d. Digital daylight sensors foot-candle readings shall be readable as follows:
        (1) Analog 0-5V/0-10V sensors connected to a digital input module shall be represented as AI1-96.
        (2) Digital closed loop sensors shall be represented as AI4001-4096.
        (3) Digital open loop sensors shall be represented as AI5001-5096.
        (4) Digital dual loop sensors shall be represented as follows:
            (a) The upward facing open loop sensor shall be represented as AI6001-6096.
            (b) The downward facing closed loop sensor shall be represented as AI6101-6196.
    e. Digital daylight sensor configuration shall be exposed as BACnet objects as follows:
        (1) Digital closed loop sensors shall be represented as follows:
            (a) Daylight Sensor Day Setpoint (ftcd) AV4201-4296.
            (b) Daylight Sensor Night Setpoint (ftcd) AV4301-4396.
            (c) Daylight Sensor Off Setpoint Delay (minutes) AV4401-4496.
            (d) Daylight Sensor On Setpoint (ftcd) AV4501-4596.
            (e) Daylight Sensor Off Setpoint (ftcd) AV4601-4696.

2.11 USER INTERFACE

A. Each lighting control panel system shall be supplied with at least (1) handheld IR remote programming interface consisting of a keypad and associated OLED display screen. The user interface shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following functions as a minimum:
1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.

3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as seen fit by the end user's representative.

2.12 CONFIGURATIONS TOOLS

A. A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include:
   1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
   2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
   3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
   4. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.
   5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting.
   6. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.13 NETWORK BRIDGE

A. The network bridge connects a DLM local network to a BACnet-compliant network for communication between rooms, panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication. Closed or proprietary network communication shall not be acceptable.

   1. The network bridge may be incorporated directly into the room controller hardware (LMRC-3xx Room Controllers) or be provided as a separate module connected on the local network through an available RJ-45 port.
   2. Provide Plug n' Go operation to automatically discover all room devices connected to the local network and make all device parameters visible to the segment manager via

the segment network. No commissioning shall be required for set up of the network bridge on the local network.

3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. Standard BACnet objects shall be provided as follows:
   a. Read/write the normal or after hours schedule state for the room
   b. Read the detection state of the occupancy sensor
   c. Read/write the On/Off state of loads
   d. Read/write the dimmed light level of loads
   e. Read the button states of switches
   f. Read total current in amps, and total power in watts through the room controller
   g. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
   h. Activate a preset scene for the room
   i. Read/write daylight sensor fade time and say and night setpoints
   j. Read the current light level, in footcandles, from interior and exterior photosensors and photocells
   k. Set daylight sensor operating mode
   l. Read/write wall switch lock status
4. WattStopper product numbers: LMBC-300

2.14 SEGMENT MANAGER

A. The Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall serve up a graphical user interface via a standard web browser. Each segment manager shall have support for one, two or three segment networks as required and allow for control of a maximum of 40 local networks (rooms) and/or lighting control panels per segment network.

B. Operational features of the Segment Manager shall include the following:
   1. Connection to PC or LAN via standard Ethernet TCP/IP.
   2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser.
   3. Log in security capable of restricting some users to view-only or other limited operations.
   4. Automatic discovery of all DLM devices on the segment network(s). Commissioning beyond activation of the discovery function shall not be required.
   5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
   6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation.
   7. Ability to set up schedules for rooms and panels. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation.
   8. Ability to group rooms and loads for common control by schedules, switches or network commands.
   9. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.
   10. Provide seamless integration with the BAS via BACnet IP. Provide export table with available parameters.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Contractor shall provide to the manufacturer all quantities for system including but not limited to relays, room controllers, relay panels, plug load controllers, switches, sensors and wire lengths and configurations for both network and device cable at least 1 week before bid.

B. When using wire for connections other than the DLM local network (Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements

C. All MSTP network and Cat 5e low voltage wiring must have “WattStopper” printed on the wire jacket. Any cable substitutions shall be removed and replaced at the contractor’s expense.

D. All MSTP network terminations shall utilize wire ferrules for terminations and MSTP network manufacturer’s instructions. Any network deficiencies shall be repaired at the contractor’s expense.

E. Electrical contractor must provide a detailed as-built plan in CAD showing MSTP network cable routing and network bridge serial numbers to the manufacturer at least 3 weeks prior to factory commissioning Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated.

F. Electrical contractor shall be responsible for scheduling the following onsite coordination meetings through the duration of the project. Attendance shall be required for the GC, EC, representative from MEP firm, BAS Integrator and lighting control rep.

1. Pre-Installation- After submittals have been approved and material has arrived onsite and before installation of any devices begins. Review lighting control layout plans, required as-built information and MSTP Terminations.
2. Pre-Factory startup- Electrical contractor must have all lighting control devices installed, wired and tested at least 90 days prior to substantial completion deadline. At this coordination meeting the electrical contractor shall walk the site with attendees and go room by room to ensure they are ready for factory technician to start the system programming. Electrical contractor shall have his as built documentation of the system completed for this meeting.
3. Move in- 30 days prior to owner move in all parties shall meet onsite to review completed system. At this time all installation and factory programming shall be completed.

3.2 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The factory commissioning shall include the following services. Programming of all button stations, configuration of all occupancy sensors and photocells. Verification of a complete and working system including MSTP network status. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

C. The electrical contractor shall request factory commissioning by submitting a startup request form at least (4) weeks before startup is required.

D. Electrical contractor must schedule lighting control factory start-up to begin at **least 60 days prior to substantial completion deadline.**

E. Lighting control technician shall issue daily reports notifying of the project status, open issues, challenges, etc. at the end of each day he/ she is onsite commissioning the system. Reports shall be sent directly to EC, GC and Engineer.

F. At the completion of the first visit of the lighting control technician, all parties shall meet onsite to walk the project and evaluate any open issues. At this meeting the schedule for owner training shall be determined.

G. The electrical contractor shall provide at least (1) journeyman electrician, familiar with the installation of the system, dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.

H. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

I. Re-commissioning – After 90 days from occupancy the factory authorized representative and electrical contractor shall re-calibrate all sensor time delays and sensitivities to meet the Owner’s Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity

J. Owner operation memo- Lighting control manufacturer shall prepare an operational memo for owner to distribute informing building occupants of the operation of their lighting control system. Memo shall explain the following but not limited to: auto on/ vs manual on, occupancy sensors, daylight harvesting, plug load control, after hours time delays.

END OF SECTION 26 09 43

SECTION 26 20 00 - ELECTRICAL DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract Documents and Division 1 - General Requirements as applicable, apply to this Section.

1.2 SUMMARY

A. Provide all electrical distribution and motor control equipment and accessories required to distribute electrical power to all motors, outlets and systems requiring power.

1.3 QUALITY ASSURANCE

A. New: Provide all new equipment.

B. Single Manufacturer: All equipment of each type shall be the product of one manufacturer.

C. UL: Equipment shall be UL listed. Service entrance equipment shall bear UL Service Entrance label.

D. NEC: Equipment and installation shall comply with the National Electrical Code.

E. Wet Locations: Equipment and enclosures installed outdoors and in wet locations shall be approved for the purpose.

F. IEEE: Institute of Electrical and Electronics Engineers Standard 1015-1997 (Blue Book) Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

1.4 LABELING

A. Nameplates and labeling shall be provided in accordance with Section 26 05 53. All feeders shall be labeled at the feeder device.

1.5 FINISHES

A. All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to a new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Engineer.

1.6 SUBMITTALS

A. Provide complete product data for each equipment type. Provide electric service studies when required.

B. Submittal shall include written recommendation from manufacturer of settings for all electronic trip adjustment setting on all equipment furnished with adjustable trip settings. Contractor is responsible for adjusting all electronic trip settings per manufacturer recommendations.

C. Electrical connections to all equipment furnished by any other division shall be coordinated with final approved equipment submittals from other divisions including but not limited to circuit breaker sizes, conduit sizes, wire sizes, fuse sizes, disconnect switch sizes and starter sizes that differ from those shown on the drawings prior to submitting Electrical Distribution Equipment submittal.

1.7 SHORT CIRCUIT CURRENT RATINGS

A. General: All switchboards and panelboards shall be fully rated and marked with a maximum short circuit current rating. The equipment manufacturer shall have verified this rating with high-amperage testing. All short circuit current ratings are expressed as amperes RMS symmetrical at the applied voltage unless otherwise noted. All equipment shall withstand the specified level of fault current. All overcurrent devices shall interrupt the specified level of fault current.

1.8 ELECTRIC SERVICE STUDIES

A. Standard: Submit studies in accordance with ANSI/IEEE Standard 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

B. Submit one-line diagram for each electrical service. Key all equipment and components on diagram to items in the studies.

C. Provide a short-circuit current analysis for each main switchboard. Short-circuit analysis shall calculate short-circuit levels at service transformer secondary, switchboard main breaker, each feeder breaker and all levels of downstream distribution equipment. Assume infinite source bus.

D. Provide a time-current coordination study for each main switchboard. Coordination study shall compare the operating levels and times of the protective devices to the withstand levels and times that the equipment can sustain without damage or failure. Determine electronic trip unit settings necessary to achieve optimal selective coordination between 480 volt main service circuit breaker and first level of feeder distribution devices. Determine setting for all adjustments of trip units of all electronic circuit breakers that are linked by zone-selective-interlocking. Furnish time-current curves for the two (or more) levels of distribution protected with electronic trips, plus the first additional distribution level served from the switchboard feeder. Show a separate composite plot for each feeder breaker trip rating with the main breaker. Plot composite time-current curves on log-log background. Add a typical frame size of downstream molded-case circuit breaker to each switchboard feeder composite plot.

E. Contractor shall make all adjustments to circuit breakers per electric service study and provide written documentation that all adjustments have been made.

1.9 OWNER'S INSTRUCTION

A. Provide a four hour period of instruction to the Owner's designated personnel upon completion of the main switchboards installation. Instruction shall include a functional training session on digital metering system operation and system test procedures. Demonstrate the transfer of metered values to the Building Automation System. Review manufacturer’s recommended switchboard maintenance. The Operations and Maintenance Manual shall be complete and on-site at the time of Owner instruction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Unless indicated otherwise, all equipment in this section shall be provided from a single manufacturer. The product designations listed are to establish a level of quality. Acceptable manufacturers are,
   1. Square D
   2. Siemens
   3. G.E.
   4. Eaton

2.2 ENCLOSED SWITCHES

A. General: Provide heavy duty enclosed switches similar to Square D Class 3100 Type HD.

B. Switch Interior:
   1. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.
   2. Lugs shall be front removable and UL Listed for 75 degrees Celsius conductors.
   3. All current carrying parts shall be plated to resist corrosion.
   4. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.
   5. Switches shall have provisions for a field installable electrical interlock.

C. Switch Mechanism:
   1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
   2. The operating handle shall be an integral part of the box, not the cover.
   3. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.
   4. The handle position shall travel at least 90 degrees between OFF and ON positions to clearly distinguish and indicate handle position.
   5. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

D. Switch Enclosures:
   1. Switch covers shall be attached with welded pin-type hinges.
   2. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel.
   3. The enclosure shall have ON and OFF markings stamped into the cover.
   4. The operating handle shall be provided with a dual colored, red/black position indication,
   5. All switches shall have provisions to accept up to three (3) 3/8 inch hasp padlocks to lock the operating handle in the OFF position.
   6. Tangential knockouts shall be provided to facilitate ease of conduit entry.

E. Switch Ratings:
   1. Switches shall be horsepower rated for ac and/or dc as indicated on the plans.
   2. The UL Listed short circuit current rating of the switches shall be 200,000 rms

symmetrical amperes when used with or protected by Class J fuses.
3. Non-Fusible: 10,000 rms symmetrical amps.

F. Fuse Clips: NEMA FU 1, Class J fuses.

2.3 SINGLE CIRCUIT BREAKERS WITH ENCLOSURES

A. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.

B. Circuit Breakers: Molded case, quick make, quick break, trip free, common thermal magnetic trip.

C. Ratings: Continuous current, poles as required, 480 volt system breaker shall interrupt short circuits up to 14,000 rms amps symmetrical; on 120/208 - 240 volt system, 10,000 amp rms symmetrical.

D. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

E. Nameplate: Provide a nameplate showing load served.

2.4 FRACTIONAL HORSEPOWER MANUAL MOTOR CONTROLLER

A. Square D - Class 2510 Type F.
1. Description: NEMA ICS 2, ac general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light and toggle operator.
2. Enclosures: ANSI / NEMA ICS 6, Type as indicated.

2.5 MAGNETIC MOTOR CONTROLLERS

A. Square D - Class 8536 Type S.
1. Description: NEMA ICS 2, ac general-purpose Class A magnetic controller for induction motors rated in horsepower.
2. Coil Operating Voltage: Provide as required to interface with controls system, including control power transformer.
3. Coil: Be of encapsulated type.
4. Poles: as indicated.
5. Size: as indicated.
6. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
7. Wiring: Straight-through wiring with all terminals clearly marked.
8. Overload Relay: NEMA ICS.
   a. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered. Provide phase loss, phase unbalance protection, permanent tamper guard, Trip Class 10 or 20 and a mechanical test function.
   b. Outputs: Units shall be designed for addition of either a normally open or normally closed auxiliary contact and shall be field convertible. Provide one (1) set of N.O. and N.C. contacts in each starter.

c. Reset: Unit shall include both manual reset and remote reset using an external module.
d. Select overload current setting based on the motor nameplate data of the actual motor to be protected. All standard NEMA sizes may be used for the overload relay, including Size 00.

9. Enclosure: ANSI / NEMA ICS 6, Type 1, 3R or 4X.
10. Control Power Transformers: 120 volt secondary. VA minimum, in each motor starter. Provide fused primary and secondary.
11. Provide red LED running pilot light and H-O-A switch.

2.6 MAGNETIC MOTOR CONTROLLERS - TWO - SPEED

A. Square D - Class 8810 Type S.
1. Description: Include integral time delay transition between FAST and SLOW speeds. Starters shall be electrically and mechanically interlocked to prohibit both starters being energized simultaneously.
2. Coil operating voltage: Provide as required to interface with controls system, including control power transformer.
3. Coil: Be of encapsulated type.
4. Poles: as indicated.
5. Size: as indicated.
6. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts.
7. Contact inspection and replacement shall be possible without disturbing line or load wiring.
8. Wiring: Straight-through wiring with all terminals clearly marked.
9. Overload Relay: NEMA ICS.
a. Solid State; Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered. Provide phase loss, phase unbalance protection, permanent tamper guard, Trip Class 10 or 20 and a mechanical test function.
b. Outputs: Units shall be designed for addition of either a normally open or normally closed auxiliary contact and shall be field convertible. Provide one (1) set of N.O. and N.C. contacts in each starter.
c. Reset: Unit shall include both manual reset and remote reset using an external module.
d. Select overload current setting based on the motor nameplate data of the actual motor to be protected. All standard NEMA sizes may be used for the overload relay, including Size 00.
10. Enclosure: ANSI / NEMA ICS 6, Type 1, 3R or 4X.
11. Two speed motor controllers shall be designed for type of motor winding specified in Division 23 Mechanical Specifications, Drawings, or Equipment Schedule. Coordinate with Division 23 prior to submittal.
12. Provide red-high, amber-low running pilot lights and H-O-L-A switch.
13. Provide two speed motor controllers for all two speed motors specified in Division 23 Mechanical Specifications, Drawings, or Equipment Schedule. Coordinate with Division 23 prior to submittal.

2.7 COMBINATION DISCONNECT / MOTOR STARTERS

A. Square D - Class 8538 Type S (Fusible or no fuse, as shown on plans).
1. Description: Combine magnetic motor controllers with fusible switch disconnect in common enclosure. Switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON/OFF with red and black color-coding.

2. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class J fuses and visible blades. Operating handle shall give positive visual indication of ON/OFF with color-coded operating handle.
3. Magnetic Motor Controllers: Refer to paragraph(s) specifying magnetic motor controllers for requirements.

2.8 FUSES (600 VOLTS AND BELOW)

A. Manufacturers:
1. Bussmann.
2. Little Fuse
3. Ferraz Shawmut

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

D. Class J (Time Delay) Fuses
1. Dimensions and Performance: NEMA FU 1.
2. Voltage: Rating suitable for circuit phase-to-phase voltage.
3. Dual-element, time delay ten (10) seconds (minimum) at 500 percent rated current.

E. Spares: Spare fuses shall be provided in the amount of ten (10) percent of each type and size installed. Replacement for fuses and limiters blown during construction shall not count as spares.

2.9 TWO-WINDING TRANSFORMERS

A. Product Description: Provide transformers in accordance with the following standards, where applicable:
1. Underwriter's Laboratory 1561, Standard for Safety for Dry-Type General Purpose and Power Transformers
2. Underwriter's Laboratory 506, Standard for Safety for Specialty Transformers
3. NEMA ST 20, Dry Type Transformers for General Applications
4. NEMA 250, Enclosures for Electrical Equipment (1000 V Max)
5. ANSI / IEEE C57.12.91, Standard Test Code for Dry-Type Distribution and Power Transformers
6. U.S. Department of Energy 10 CFR Part 431 Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule, dated April 18, 2013. These efficiency standards shall take effect January 1, 2016. All transformers covered in the scope of this document and this specification, manufactured after December 31, 2015, shall be compliant with the new standard.

B. Ratings as indicated on Drawing.

C. Primary Voltage: 480 volts, 3 phase or as indicated on plans.

D. Secondary Voltage: 208Y/120 volts, 3 phase or as indicated on plans.

E. Insulation system and average winding temperature rise 150 degrees Celsius over 40 degrees Celsius ambient.

F. Winding Taps:
1. 2 at 2.5 percent above rated voltage.

2. 4 at 2.5 percent below rated voltage.

G. Sound Levels: NEMA ST 20. Noise levels shall not exceed NEMA and ANSI Standards.

H. Basic Impulse Level: 10 kV for transformers less than 300 kVA.

I. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.

J. Mounting:
1. 1-15 kVA: Suitable for wall mounting.
2. 16-75 kVA: Suitable for floor mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

K. Coil Conductors: Continuous copper windings with terminations brazed or welded.

L. Enclosure: NEMA ST 20, Type 1 or Type 3R ventilated. Furnish lifting eyes or brackets.

M. Isolate core and coil from enclosure using vibration-absorbing mounts.

N. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.10 TRANSFORMERS FOR NONLINEAR LOADS

A. Nonlinear load transformer shall be as specified for two winding transformers except as modified by this Section.

B. Product Description: NEMA ST 20, factory-assembled, air cooled dry type transformers, designed to supply nonlinear load, UL K-9 rated.

C. Primary Voltage: 480 volts, 3 phase.

D. Secondary Voltage: 208Y/120 volts, 3 phase.

E. Insulation and temperature rise: Class 220 insulation system with 115 degrees Celsius average winding temperature rise over 40 degrees Celsius ambient.

F. Coil Conductors: Continuous copper windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at 1.73 times the phase conductor ampacity.

G. Enclosure: NEMA ST 20, Type 1 or Type 3R ventilated. Furnish lifting eyes or brackets.

H. Isolate core and coil from enclosure using vibration-absorbing mounts.

I. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.11 DISTRIBUTION PANELBOARDS

A. Manufacturers: Square D I- Line, Class 2110.

B. Product Description: NEMA PB 1, circuit breaker type panelboard.

C. Panelboard Bus: copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

D. Continuous current rating shall be sufficient to protect wiring and equipment served.
1. Panels 400A and smaller, 35,000 amperes rms symmetrical.
2. Panels greater than 400A: 65,000 amperes rms symmetrical.

E. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

F. Main Circuit Breaker:
1. When distribution panel has main circuit breaker, provide molded case circuit breaker with electronic trip unit. Current sensing to be true-rms.
2. Main breaker shall have minimum interrupting rating of 65,000 amperes rms symmetrical at applied voltage.
3. Electronic trip shall be Square D micrologic with adjustable long-time, short-time and instantaneous pick-up set points.

G. Cabinet Front: Safety dead front type. Conform to NEMA 1; NEMA 3R if located outdoors. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.

2.12 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers: Square D Type NQ for 208/120V, type NF for 480/277V.

B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard;

D. For non-linear load applications subject to harmonics furnish 173 percent rated, plated copper, solid neutral.

E. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208-240/120 volt panelboards; 22,000 amperes rms symmetrical for 480 volt panelboards.

F. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.

G. Enclosure: NEMA PB 1, Type 1 or Type 3R. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.

H. Cabinet Front: Safety dead front type with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

I. Provide ground-fault circuit breaker for each heat trace branch circuit.

J. Panelboards indicated to have thru-feed lugs shall be furnished with thru-feed lugs in all sections of panelboard.

2.14 MAIN SWITCHBOARDS:

A. General: Provide universal building–type switchboards fabricated in accordance with NEMA Standard PB–2, UL Standard 891, and bearing a UL Service Entrance Label. Switchboard characteristics are 480/277 volts, 3 phase, 4 wire. Main connection and unit-mounted branch connections shall be from the rear. Group mounted branch connections shall be from the front or the rear. The entire switchboard assembly shall be similar to Square D Type QED-2.

B. Structure:
1. The switchboard shall be freestanding and have front and rear alignment. Provide rear access to main device(s) and all unit-mount branch devices (2000A and less can be front access only). Provide front or rear access to group-mounted devices. Formed up steel channels bolted together to form a rigid structure to which formed up fronts, side sheets, and rear covers are bolted. Galvanized 1–1/2" x 3" mounting channels on bottom, rear, left, and right sides to close all openings at the bottom. Arrange for easy addition of future cubicles at end. Provide pull box, fabricated with unit at factory, on top of switchboard if required for proper entrances and exits of feeders.
2. When “SPACE” is indicated on one-line diagram, provide full bussing extension to serve that space and all overcurrent device mounting hardware for the given frame size.

C. Installation: Freestanding, level and bolted to a four (4) inch concrete pad.

D. Instrumentation:
1. General: Monitor the incoming line with a Square D PM 5563 meter with BACnet IP communication port protocol.
Meter shall have digital display adjustable to select phase. Monitor with an ammeter any feeder devices indicated on the Drawings.
2. Wiring Lugs: Provide ring lugs for all wiring terminations of potential transformers (PTs), current transformers (CTs) and current sensors. Fork lugs are not acceptable. Ring lugs are intended to minimize the chance of leads pulling apart and creating an open circuit. (Zero current reading).

E. Phase, Neutral and Ground Bussing: Silver plated 98% conductivity copper sized to comply with NEMA Temperature Rise Standard. In addition, copper bus shall be sized on the basis of a maximum temperature rise of 65 degree C. The vertical bussing per cubicle shall be sized not less than the sum of all devices, including spare spaces, to be served from that cubicle. **The vertical bus shall be a minimum of 2000 amperes and shall be full height**. Bus supports, connections, and joints shall be bolted with SAE Grade 5 medium carbon steel bolts employing Belleville washers. Provide complete bussing, mounting provisions for circuit protective devices and space screw cover wherever the drawings indicate space only. Arrange and drill bussing for **future full capacity extension**. Provide a full length ground bus, with minimum ampacity of 1/3 phase bus ampacity. Provide full–size neutral rated at 100 percent of phase bus.

F. Terminations: Provide proper incoming line lugs to accommodate cable shown on plans.

G. Short Circuit Ratings:
1. Switchboard assembly of protective devices, together with the bussing and bracing, shall be fully-rated to withstand and interrupt short circuits on a system capable of delivering up to 100,000 amps RMS symmetrical at nominal system voltage.

H. Provisions for Auto Power Factor Controller (APFC):
1. Provide a circuit breaker with adjustable electronic tripping to protect and disconnect the automatic power factor controller.
2. Set amp trip at minimum 150 percent of ampacity for the actual KVAR installed.
3. Provide buss CTs on main incoming buss for use by the remote auto pf controller. These CTs shall be separate and in addition to all other CTs required for switchboard metering. Install a shorting terminal block on CT until the auto pf controller is installed at the job site.
4. Refer to Section 26 35 33 for additional requirements of auto pf controller.

I. Protective Devices:
1. Switchboard Main Breaker:
a. Stationary mounted, manually operated, 100 percent rated molded case circuit breakers with electronic tripping system and stored energy closing mechanisms. The electronic tripping system shall be similar to Square D Micrologic Full Function Trip unit. Main breakers shall be Square D NW 3000-4000), 100KA ampere frame size.
b. The breaker shall be UL Listed for continuous duty at 100% of the current rating.
c. Minimum interrupting rating of 100,000 amperes rms symmetrical at 480/277 Volts.
d. Local trip indicators: overload, short circuit and ground fault.
e. Electronic sensing systems shall be true-RMS sensing and not susceptible to adverse harmonic current effects.
f. Adjustments:
1) The electronic trip unit shall have LSIG Trip functions.
2. Feeder Devices:
a. Breakers 700 Amps and Larger:
1) Branch feeder breakers 700 amp and larger shall be molded case circuit breakers rated 100% with electronic trip units, similar to Square D [NW 3000-4000A 100%, [RL (1600-2500A 100kaic 100%, PL (700-1200A 100kaic 100%)
2) Interrupting rating shall be at least 100,000) amperes rms symmetrical at 480/277 Volts.
3) The electronic trip unit shall have LSI trip functions.
4) The breaker shall be UL Listed for continuous duty at 100% of the current rating.
b. Breakers 600 amps and smaller shall be type L (600A and 400A frame), J (250A frame), and H (150A frame) molded circuit breakers, AIC rating to match main breaker.
c. The breaker shall be UL Listed for continuous duty at 100% of the current rating

J. Transient Voltage Surge Suppressor (TVSS):
1. General: Provide a Square D Class 1310 240kA surge current rated mounted in the switchboard mounted above the main circuit breaker compartment.

K. Lightning and Overvoltage Surge Arrester:
1. General: Provide a Square D SDSA3650 lightning and overvoltage surge arrester inside the switchboard housing, connected between the service entrance bussing and the ground bus.

2. Description: Device shall be a heavy duty, three–phase, zinc metal oxide varistor (MOV), secondary class arrester rated for 650 volts and U.L. listed in Category (OWHX) of the Electrical Construction Materials Directory (Green Book). Device shall comply with ANSI/IEEE C62.11-1987 Standard for Metal Oxide Surge Arresters for AC Power Circuits.
3. Installation shall comply with NEC Article 280. Provide fusing if required by installation instructions from arrester manufacturer.

L. Identification:
1. General: Identify each device and meter with a nameplate showing load served. Refer to Article on LABELING in Section 26 05 00.
2. Master Nameplate: Provide a master nameplate on face of boards similar to following, with correct data shown:

Main Switchboard_____
480/277 Volts, 3 Phase, 4 Wire, 60 Hertz
Main Bus:___amps. braced for___ RMS sym. amps.
Date Installed:

M. Submittal: Include at least the following:
1. Manufacturer and Model Numbers
2. Dimensions
3. Cable Termination Provisions
4. Current Ratings
5. Voltage Ratings
6. Short Circuit Ratings
7. Protective Device Ratings
8. Electronic metering system
9. Surge Arrester
10. Unit Elevation
11. Bussing Schematic, Sizes and Statement of Conductor and Plating Materials
12. Original Manufacturer Brochure and Specifications
13. Coordination drawing using dimensions of actual switchboard submitted. Show board footprint, proper clearances, and other equipment in same room.

N. Testing: Test all devices and systems to assure proper operation.

2.15 SERVICE ENTRANCE CABLE TAP BOX (CTB):

A. Cable Tap Box:
1. General: Provide weatherproof, freestanding phase collection and cable tap box. Fabricate in strict accordance with Electric Utility requirements. Line side connection from building pad-mounted transformer shall be through underground conduit and wire, load side connections to the building main switchboard(s) shall be weatherproof outdoor busway.
2. Structure: Formed up steel channels bolted together to form a rigid structure to which formed-up fronts, side sheets, and rear covers are bolted. Front and rear doors shall be hinged. Galvanized 1-1/2 inch x 4inches mounting channels on bottom, rear left, and right sides to close all side openings at the bottom. Interior framing shall be galvanized steel 1-5/8" rigid channel or approved equal system. Enclosure shall be tamper proof and outdoor weatherproof.
3. Installation: Freestanding and level on an outdoor concrete pad. Provide anchor bolts. Pad shall be outside all Electric Utility easements. Stub up conduits for

Electric Utility service lateral and customer-side service entrance conduits. All underground conduit to/from CTB shall be concrete-encased.

4. Bussing: Insulated bussing, silver plated 98 percent conductivity copper. Bussing shall be sized in accordance with UL and NEMA Standards. In addition, size copper bus for not more than 1000 Amperes per cubic inch current density. Provide 3 phase, 4 wire, (100 percent neutral) bussing. Install with rigid supports to meet fault current rating.
5. Fault Current Rating: Bussing and bracing shall safely and without failure withstand short circuits on a system capable of delivering up to 100,000 amperes rms symmetrical at nominal system voltage. Install rope tie as required after cable installation to maintain bracing for short circuit current rating.

B. Electric Utility Requirements:
1. Prior to fabrication, submit three (3) prints of proposed cable tap box (CTB) to the representative designated by the Electric Utility. Submit prints only after shop drawings have been submitted and review cycle is complete with the Architect. Allow at least eight weeks time for review by Electric Utility prior to desired date of new service cut-in. Allow additional time for Architect/Engineer review prior to submittal to Electric Utility.
2. Cable tap box enclosure shall be tamper proof and weatherproof. Entire cabinet shall be tamper-resistant.
3. Form roof with cross-kink to force water to run off the cabinet.
4. Paint Finish Color: Match color of Electric Utility padmount transformer. Minimum finish shall be prime coat plus at least 6 mils of finish coat paint in two (2) applications.
5. Provide full-height doors on both utility side and customer side. Each door shall be hinged and have a vault-style handle with padlocking provisions. Electric Utility will install its padlock. Provide weatherproof padlock on customer door and give Owner ten (10) copies of key.
6. Fabricate CTB with two separate compartments; one side for Electric Utility connections and the opposite side for Customer connections. Compartments shall be separated with an insulating barrier. Size cabinet to maintain necessary wire bending radius in Electric Utility and Customer compartments.
7. All insulating barriers shall be one (1) inch black phenolic resin, NEMA Grade N-1 or XX, or phenolite (Grade GPO-3).
8. Each bus bar shall be copper, minimum 1/4 inch x 4 inches. Drill and tap for six (6) sets of 2-hole compression lugs per bus bar on Electric Utility side or other configuration stipulated by E.U. Lowest edge of all bus bars shall be 36 inches above top of concrete foundation. All bus bar dimensions, quantities, bracing and exact layout shall be per approved details from the Electric Utility for this specific job site. Parallel sufficient bus bars to achieve ampacity shown on Electrical Drawings for both Electric Utility and Customer side of CTB. Drill and tap for 2-hole NEMA D-tang compression lugs for termination of Customer cables.
9. Install CTB level and bolted to a concrete foundation. Locate outside work space clearance and easements associated with Electric Utility padmount transformer and primary ductbank.
10. Cable Termination: Terminate all cables with NEMA-pattern, two-hole, compression lugs.

C. Submittal to A/E: Include at least the following:
1. Manufacturer and Model Numbers
2. Dimensions: plan, elevations, bus bars.
3. Cable Termination Provisions
4. Current Rating
5. Voltage Rating
6. Short Circuit Withstand Rating

7. Bussing Sizes, Layout and Statement of Conductor and Plating Materials
8. Certify weatherproof cabinet construction. Certify paint finish type and thickness.
9. Coordination Drawing showing cable tap box, Electric Utility padmount transformer with required work space clearances, meter location, and underground conduit entrances.
10. After A/E shop drawing cycle is complete, submit three complete copies to Electric Utility.

2.16 SEQUENCING PANELBOARD FOR THEATER SOUND REINFORCEMENT SYSTEM:

A. Features:
1. Supply all ac circuits for audio/visual equipment in the high school theater A/V room from time sequence panelboard capable of being remote controlled from multiple locations.
2. 41 sequenced circuits per panelboard.
3. A means of visual operator feedback shall provide an indication of the progress of the power turn-on and turn-off sequence at each control point.
4. Sequencing shall have an adjustable time delay between the low level equipment circuits and the power amplifier circuits.
5. The sequencing system shall be capable of shedding the load within three (3) seconds after a power failuer and re-sequencing when power resumes without operator intervention.
6. Provide one LynTec Cat. No. SS-2 Sequencer Switch Set with every 41-circuit panelboard.
7. Provide one LynTec Cat. No. SS-2PL Remote Locking Switch Plate with every 41-circuit panelboard.
8. Provide for each sequencing panelboard a LynTec Model No. SLC 341-41 filled with MB-Motorized Breakers, 3 phase, 4 wire, 208Y/120 Volt 225 Amp Main Breaker panel or approved equal.
9. Acceptable Manufacturer: LynTec Inc., 8401 Melrose, Lenexa, KS 66214-1647; telephone 800-724-4047, fax 888-722-4157, www.lyntec.com or email info@lyntec.com .

B. Cabinet: Safety dead front type; box made of Code gage galvanized steel; minimum gutter space 4" on all sides but not less than NEC requirements; door with flush type latch. Enclosure shall conform to NEMA 1.

C. Circuit Breakers:
1. General: Provide a breaker for each audio branch circuit to protect wiring and equipment served.
2. Description: Each breaker shall have motor drive for individual breaker remote control. Breakers shall be quick make, quick break, trip free, thermal magnetic trip. Automatic trip shall be indicated by the handle at the midpoint position. Multiple pole breakers shall have common trip.

D. Short Circuit Ratings: 120/208 volt systems 10,000 amperes RMS symmetrical.

E. Phase, Neutral and Ground Bussing: Silver or tin plated 98 percent conductivity copper sized in accordance with NEMA Temperature Rise Standards and installed completely throughout panel for installation of future breakers where schedule shows space only. Provide an equipment grounding bus bonded to the panel cabinet. Ground bus shall have a terminal screw for every breaker in the panel.

F. Termination: Provide proper incoming line lugs. Size lugs to accommodate wire which is to be installed.

G. Surge Protective Device: Install a Transient Voltage Surge Suppressor (TVSS) on the sequencing panelboard. TVSS shall be Current Technology TransGuard TG60 Series or Liebert Interceptor Model 111 Series.

H. Nameplate: Nameplate on front face showing panel name and voltage. Coordinate to give same name as shown on Drawings.

I. Directory: Complete at end of job, typewritten, contained in frame on the inside of the panel door. Frame shall have a protective plastic shield. Label every breaker to match directory.

2.17 ELEVATOR SHUNT TRIP DISCONNECT

A. Provide Bussman Power Module Switch PS Series; amperage size and operating voltage shall match elevator branch circuit indicated on drawings.

B. Provide control power transformer, fire alarm system interface relay, key-to-test switch, mechanical interlock auxiliary contact for hydraulic elevators with automatic recall.

C. Interconnect with local heat detectors to provide elevator shutdown prior to the discharge of fire protection water in elevator machine room.

2.18 ROOF MOUNTED PEDESTALS

A. Roof Utility Pedestal with 20 Amp GFCI/Weatherproof receptacle - Provide MAPA Products utility roof pedestal #MPX-20G: 36/12.

B. Roof Pedestal with Non-Fused Disconnect Switch and 20 Amp GFCI/Weatherproof receptacle - Provide MAPA Products roof pedestal #MDP – (XX). See plans for disconnect sizes.

PART 3 - EXECUTION

3.1 MOUNTING:

A. General: All equipment shall be securely fastened in place.

B. Locations: In all cases mounting locations shall comply with the requirements of the National Electrical Code. This shall include providing suitable working clearances.

C. Concrete Pads:
1. Provide concrete in accordance with the Division of the Specifications for that product.
2. Indoor concrete pads shall consist of a four (4) inch pad with beveled edges extending two (2) inches beyond the perimeter of supported equipment. Switchboards, motor control centers, transformers greater than 15 KVA, and engine generators shall be installed on a pad. Refer to the drawings and the specifications for each piece of equipment to determine what other equipment shall be mounted on a pad.
3. All equipment, ground mounted outdoors, shall be mounted on a pad. Outdoor pads shall be minimum of one foot thick reinforced with #4 rebar one (1) foot on center each way. Size outdoor pads with at least four (4) feet working clearance in front of equipment and one (1) foot on all sides. Provide anchor bolts for pad-mounted equipment. Refer to Detail on drawings.

D. Wall Mounted Equipment: Wall mounted equipment shall be suitably positioned on the wall. Equipment mounted on exterior basement wall shall have unistrut channels between the wall

and the equipment to prevent condensation problems. Where wall mounted equipment is specified, but a convenient wall not available, a suitable unistrut mounting stanchion anchored in concrete shall be provided. In lieu of this stanchion, small devices may be mounted on to the equipment served if approved by the equipment manufacturer.

E. Motor rated disconnects: Install disconnects in a vertical orientation with off in the down position.

3.2 DELIVERY, STORAGE AND HANDLING:

A. General:
1. Store all types of electrical power distribution equipment in a clean, heated building affording appropriate physical protection. Control access to prevent unauthorized tampering with the equipment. However, equipment may be stored in other inside or outside environments under approved conditions.
2. Inspect equipment when received at Project site for shipping damage. Report as required by freight carrier to recover repair or replacement costs from the freight carrier in the event damage was sustained.
3. Covers are required unless indoor, ventilated storage conditions exist. Canvas tarpaulins or the equivalent are preferred over other coverings because they provide better humidity control and enclosure scuff protection. Where exposed to moisture, covers shall be waterproof.
4. The manufacturer's shipping skids shall be left on the equipment to provide structural support until the equipment is set in final resting place.
5. Refer to Section 26 05 00 for additional requirements. Contractor shall furnish new equipment to replace any equipment that is exposed to weather or subjected to other deleterious effects of construction.

B. Approved Conditions for Equipment Storage:
1. General: Where storage conditions specified above are not available, indoor or outdoor storage shall comply with the following.
2. Switchboards, Motor Control and Other General Distribution and Utilization Equipment:
a. Store metal-enclosed equipment in the upright position. Provide good ventilation of the shelter and protection from dirt, moisture and physical damage.
b. Space heaters furnished with the equipment shall be connected to a continuous source of power of the proper rating. Where space heaters are supplied from auxiliary power transformers, care shall be taken that low-voltage heater circuits are properly isolated before power source connection to prevent inadvertent energizing of the auxiliary transformer and associated high-voltage primary wiring.
c. Ambient conditions may allow condensation inside waterproof covers. If condensation is occurring, temporary heaters or lamp banks shall be provided of sufficient wattage to prevent condensation.
d. Contractor shall ensure that equipment stored in shipping cases receives adequate ventilation to avoid mildew and prevent condensation.

C. Transformer
1. Indoor storage shall be provided for all transformers.

3.3 GROUND FAULT PROTECTION OF EQUIPMENT:

A. General: Provide for system performance testing as required by the National Electrical Code. Provide each ground fault relay, sensing device or ground fault protection system with instructions and a test form. The form shall be retained by those in charge of the building's

electrical installation and be available to the authority having jurisdiction. The instruction content shall be as required by UL.

3.4 TRANSFORMER VIBRATION ISOLATION:

A. Floor Mounted Transformers: Install on concrete housekeeping pad with Mason Industries Type WM Neoprene Waffle pad, or equal. Provide Type WM isolation for elevated rack installation.

B. Wall Mounted Transformers: Install Mason Industries Type WM Neoprene Waffle pad between the wall brackets and the wall.

C. Suspended Transformers: Install Mason Industries PC30 Pre-compressed spring hanger with neoprene isolator.

D. Floor Mounted Transformers Greater than 150 kVA: Install on Mason Industries, Inc, or equal, unhoused spring isolators with acoustical pad bonded to bottom. Isolators shall be undamped free-standing spring isolators sized for a minimum of two (2) inches of static deflection. The spring outside diameter shall be no less than 80 percent of the spring operating height. The spring shall have remaining travel to solid of no less than 50 percent of the static deflection. Provide a 1/4 inch neoprene friction pad bonded to the spring base. Bolt each vibration isolator unit to concrete pad, and bolt transformers to the vibration isolator units, using the leveling bolts and nuts provided with the unit.

3.5 TRANSFORMER VENTILATION:

A. Transformers with ventilating openings shall be installed so that the ventilating openings are not blocked by walls or other obstructions. The required clearances shall be clearly marked on the transformer.

3.6 POWER SHUT OFF UNDER KITCHEN HOODS:

A. NFPA:
1. Comply with NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations. The operation of any extinguishing system shall automatically shut off all sources of fuel and heat to all equipment requiring protection by that extinguishing system.
2. Comply with NFPA 17, Standard for Dry Chemical Extinguishing Systems.
3. Comply with NFPA 17A, Standard for Wet Chemical Extinguishing Systems.

B. Shunt Trip: All electrical sources located under the ventilating equipment (cooking equipment hood) shall be shut off upon the operation of a wet chemical or water fire extinguishing system. Provide shunt trip accessory on each circuit breaker serving an electrical appliance under the hood. Install control wiring between shunt trips and the hood extinguishing system. Coordinate all wiring with supplier of hood fire suppression system for proper selection of shunt trip coil voltage, momentary or maintained-contact closure to activate shunt trip and inter-connections. Operation of a hood extinguishing system shall automatically shunt trip all associated circuit breakers.

C. Fire Alarm System: The operation of any extinguishing system shall automatically signal the building fire alarm system. Refer to Section 26 05 53 for additional fire alarm system requirements.

3.7 LABELING:

A. Nametag: Provide a nametag for each piece of distribution equipment; see Section 26 05 53, Electrical Identification.

END OF SECTION 26 20 00

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes wall switches; wall dimmers; receptacles; device plates and box covers. All devices shall be installed in outlet boxes of required size and volume.

1.3 REFERENCES

A. National Electrical Manufacturers Association: Wiring devices shall comply with NEMA Standards WD-1 and WD-6.

B. Wet Locations: Wiring devices and their enclosures installed outdoors and in wet locations shall be approved for that purpose.

C. Minimum Raceway Size: 3/4 inch.

1.4 SUBMITTALS

A. Submit manufactures product data for all wiring devices, indicate intended color and coverplate.

PART 2 - PRODUCTS

2.1 GENERAL

A. All devices shall be suitable for use intended, and have voltage and current ratings adequate for loads being served.

2.2 WALL SWITCHES

A. Single Pole Switch, Toggle Style:
   1. Leviton 1221 Series, 20A, 120/277V.

B. Double Pole Switch, Toggle Style:
   1. Leviton 1222 or 3032 Series, 20A or 30A, 120/277V.

C. Three-way Switch, Toggle Style:
   1. Leviton 1223 Series, 20A, 120/277V.

D. Four-way Switch, Toggle Style:
   1. Leviton 1224 Series, 20A, 120/277V.

E. Indicator Switch, Toggle Style:
   1. Leviton 1201 Series, 20A, 120/277V. Switch illuminated when load is on.

F. Locator Switch, Toggle Style:
   1. Leviton 1221 Series, 20A, 120/277V. Switch illuminated when load is off.

G. Digital Time Switch:
   1. Wattstopper TS-400 digital time switch with optional visual warning to flash lights at 5 minutes and 1 minute prior to time-out.

H. Key lock switches:
   1. Provide key lock switches for corridor lighting and other locations indicated on electrical drawings.
   2. 20 Amp rated.
   3. 120/277 Volt ac rated.
   4. Key-lock mechanism can only be turned ON or OFF with key.
   5. Single pole: Leviton 1221-2KL or approved equal.
   6. 3-Way: Leviton 1223-2kl or approved equal.
   7. 4-Way: Leviton 1224-2kl or approved equal.
   8. Provide 302 stainless steel wall plate for each switch.
   9. Provide 2 keys on ring for each switch.
   10. Include a brass tag on every key switch ring. Engrave tag; Example: “Hall East Lights”.
   11. Key all switches alike to match the owners standard key. Coordinate with school District for key match.

I. Color: As selected by Architect.

2.3 MOTOR RATED SWITCHES

A. Provide where a switch is indicated as a local disconnect for all mechanical and plumbing equipment.

B. Leviton MMS Series.

2.4 WALL DIMMERS

A. Manufacturers:
   1. Lutron Nova "T" Series.

B. Product Description: Semiconductor dimmer for incandescent lamps with ON-OFF switch.

C. Body and Handle: Linear slide handle, color as selected by Architect.

D. Voltage: 120 volts.

2.5 RECEPTACLES

A. Single Convenience Receptacle:
   1. Leviton 5362A Series, 20A/125V.

B. Duplex Convenience Receptacle:
   1. Leviton 5362 Series, 20A/125V, respectively.

C. GFCI Receptacle:
   1. Leviton 7899 Series, 20A/125V.

2. Provide GFCI receptacles for all receptacles on 120v circuits installed in kitchens, bathrooms and outdoors (including rooftops).

D. Isolated Ground Duplex Receptacle:
1. Leviton 5362-IG, 20A/125V.

E. Duplex Tamper Resistant Receptacle/ USB Charger
1. Leviton T5832. Duplex 20A/125V receptacle with two 3.6A, 5VDC, 2.0 Type A USB Chargers.

F. Provide 20 amp receptacle for single-receptacle branch circuits.

G. For locations where a quadruplex or fourplex is required, provide 2-duplex receptacles under common coverplate.

H. Color: As selected by Architect.

2.6 WALL PLATES

A. Type 302 Stainless Steel with matching mounting screws.

2.7 MANUFACTURERS

A. Each type of wiring device shall be furnished by one (1) manufacturer. The following will be acceptable providing the project specifications:
1. Leviton
2. Pass & Seymour
3. Hubbell / Bryant
4. Cooper

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect abandoned circuits and remove raceway, wire, and cable. Remove abandoned boxes when connecting wire and cable is abandoned and removed. Install blank cover for remaining abandoned boxes.

B. Maintain access to existing boxes and wiring connections remaining active and requiring access.

C. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

3.2 INSTALLATION

A. Route raceway and cable to meet Project conditions.

B. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

C. Adjust box location up to ten (10) feet prior to rough-in when required to accommodate intended purpose.

D. Do not install flush mounting box back-to-back in walls; install boxes with minimum 24 inches separation.

E. Install devices plumb and level.

3.3 MOUNTING HEIGHTS

A. As indicated on Drawings or if not indicated in accordance with the Architects instructions. All other telephone, Data, TV, etc. outlets shall be same as receptacle.

3.4 GANGED SWITCHES

A. Install permanent barrier between all 277 Volt light switches ganged into one outlet box.

B. Where multiple switches are grouped on one location, install switches under a one piece, multi-gang cover plate.

C. Other telephone, data, TV, etc. outlets shall be same as receptacle.

3.5 GFCI

A. Provide ground-fault circuit-interrupter type receptacles for all 15 and 20 amp receptacles shown on drawings in bathrooms, kitchens, mechanical rooms and outdoors.

END OF SECTION 26 27 26

SECTION 26 32 13 - EMERGENCY GENERATORS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide an emergency power system for emergency egress lighting, fire alarm system, emergency elevator operation, and other emergency power loads required.

B. Provide all labor, materials, and equipment as necessary to complete all work as indicated on
the drawings, and as specified herein.

C. Products supplied but not installed under this section. Products shall be turned over to the
Owner.
1. Emergency generator system equipment as follows:
   a. Complete set of all special tools required to operate and service the equipment as recommended by the manufacturer for field maintenance.
   b. One oil filter replaceable element.
   c. One air filter replaceable element.

D. Related Sections:
1. Division 1 - General Requirements
2. Applicable sections of Division 16 - Electrical
3. For emergency generators: Fuel gas piping, exhaust gas piping, flexible pipe connections, cooling air duct work, assembling generator accessories.

E. Power Source: Provide an on-site engine-generator set to generate power for distribution to emergency and standby loads by the emergency power distribution system. Engine-generator set shall be constructed of all-new components.

F. Transfer: Power to emergency loads shall be automatically transferred from normal utility power to the emergency engine generator upon loss of normal power. Transfer and assumption of load shall occur in ten (10) seconds or less. Loads shall be automatically retransferred upon restoration of normal source.

G. Distribution System: Distribution equipment devices, and circuits shall be provided as required to distribute power to emergency loads.

1.3 REFERENCES

A. Emergency generators shall be in accordance with the latest applicable standards as recommended by, SAE, IEEE, and ANSI/NEMA MG-1 Motors and Generators.

1.4 SUBMITTALS

A. Shop Drawings:
1. Emergency generator systems including:
   a. Engine-generator set and foundation requirements.
   b. Auxiliary and remote equipment.
   c. Make of engine, number of cylinders, compression ratio, bore and stroke, cylinder displacement, and speed.
   d. Make of generator, electrical rating, number and type of bearings, and exciter type.
2. Plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements,
and electrical diagrams including schematic and interconnection diagrams.
3. Product data showing dimensions, weights, ratings, interconnection points, and internal
wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer and vibration isolators.
4. Installation instructions.
5. Name, location and phone number of nearest authorized distributor/service facility.
6. Sequence of Operation - Manufacturer shall prepare a detailed, typewritten sequence of operation and submit as part of the approval documents. Final approved sequence of operation shall be permanently encapsulated in plastic laminate and permanently attached to the equipment. Format shall be 8½" x 11" or 11" x 17" as appropriate.
7. Include schematic one-line diagram with appropriate symbols and nomenclature properly referenced to text.

B. Product Data:
1. Specification Review: A complete item by item, line by line specification review.
2. Output current Amperes and electrical kW rating of engine-generator set.
3. Brake horsepower rating of engine.
4. Fuel consumption at 100 percent, 75 percent and 50 percent load.
5. Cooling requirements.
6. Sound level (dBA measured on longitudinal and perpendicular axis at ten (10) feet).
7. Manufacturer's technical data for generator, governor, voltage regulator, and battery charger. Governor submittal shall also identify method of overspeed protection to be furnished.
8. Generator sub-transient reactance Xd", per unit
9. Generator short circuit current, three-phase amperes.
10. Generator voltage waveform distortion, measured at Full Load, line-neutral, both total harmonic distortion (THD) and maxim single harmonic order THD.
11. Generator output circuit breaker(s), including proof or UL listing.
12. Transfer Switch: Show complete data showing compliance. Include continuous and withstand current ratings of all contacts.

C. Manuals and Test Data
1. Operation and Maintenance Manuals for all major components including instructions for normal operation, routine maintenance requirements, service manuals for generator, engine, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.5 QUALITY ASSURANCE

A. Authority Having Jurisdiction:
   1. General: The system shall comply with all applicable Codes and Ordinances as interpreted and enforced by the local authority having jurisdiction.

B. National Electrical Code: The system shall comply with NFPA 70, National Electrical Code, including: 1) Article 445, 2) 700.

C. NFPA:
   1. General: Comply with applicable requirements of NFPA Standards, including the following:
      a. NFPA 37: Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines.
      b. NFPA 101: Life Safety Code.
      c. NFPA 110: Standard for Emergency and Standby Power Systems.
         1) Type ten (10) seconds.
         2) Natural gas utility pipeline
         3) Category B (engine-generator set).
         4) Level 1
      d. NFPA 54: National Fuel Gas Code.

D. UL:
   1. General: Comply with applicable requirements of UL Standards, including the following.
      a. UL 1008: Automatic Transfer Switches, Fourth Edition or later.
      b. ANSI / NEMA: Comply with applicable requirements of ANSI / NEMA MG 1, "Motors and Generators", and MG 2, "Safety and Use of Electric Motors and Generators".
      c. IEEE: Comply with applicable portions of IEEE Std 446-1987, "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications" (Orange Book)

E. EPA:
   1. General: Comply with all applicable EPA requirements.

1.6 OWNER'S INSTRUCTIONS

A. Provide a four (4) hour period of instruction to the Owner's designated personnel upon completion of the system installation. Run engine-generator set and review remote annunciator panel for typical readings. Explain operation of generator remote stop switch. Demonstrate complete transfer sequence of utility-generator-utility. Operations & Maintenance Manual shall be complete and on-site for use during Owner's Instruction.

1.7 WARRANTY

A. Furnish full parts and labor warranty to cover the entire engine generator package and automatic transfer switch including all accessories, components, controls, batteries, etc. for five years. Warranty shall begin from date of Certificate of Substantial Completion. Provide a sample of manufacturer’s warranty certificates within equipment submittal. Warranty start dates from shipment or start up will not be accepted.

B. In addition to full parts, labor, the Standard and Extended warranty shall include miscellaneous materials, travel time, incidental expenses, normal freight/shipping, oils, lubricants, belts, filters, etc. and any expenses related to service calls required to diagnose and correct warranty issues. No purchase order number shall be required by

the owner for service calls within warranty period. Purchase order number can be issued after problem is determined not to be a warranty issue.

C. The manufacturer shall provide factory certificates for each Generator and associated Automatic Transfer Switch listing at a minimum the model, serial number and warranty information as specified above. Payment to contractor may be held if warranty certificates are not provided in a timely manner.

D. All warranty work shall be performed by factory direct service technician. Warranty work shall not be performed by installing contractor.

1.8 MAINTENANCE

A. Furnish one set of tools required for preventative maintenance of each engine generator system. Package tools in adequately sized metal tool box.

B. Provide two spare sets of each oil, and air filter element required for each engine generator system.

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION

A. Furnish and install new [natural gas] [diesel] engine driven electric generating unit, factory assembled single unit generator set, with continuous output voltage of 480Y/277, 3 phase, 4 wire, at 0.8 power factor, 60 hertz, grounded neutral service, fully rated for operation at the job site altitude at an ambient temperature range of 120 degrees Fahrenheit maximum to -0 degrees Fahrenheit minimum, all mounted on a common steel base suitable for mounting on a concrete foundation pad, complete with a derangement panel and all accessories as specified and required for normal operation in standby service.

B. Acceptable Manufacturers:
1. Caterpillar
2. Cummins/Onan
3. Kohler

C. Manual and Automatic Start - Unattended Operation
1. Manual start shall be done by operating the “start” button on the generator or selecting "manual” on the manual-off-automatic selector switch on the automatic transfer switch.
2. Automatic start shall be done by the automatic transfer switch when the manual-off-automatic selector switch on the automatic transfer switch is in the “automatic” position.

D. Voltage and frequency regulation.
1. Engine/generator shall deliver rated output (kVA) at rated frequency and power factor, at not more than two (2) percent above or below rated voltage.
2. Voltage regulation shall be plus or minus two (2) percent for any constant load between no load and rated load. Random voltage variation shall not exceed ± 1 percent for any constant load. Voltage recovery to 100 percent normal output shall take no longer than two seconds after single step application of 100 percent rated load.
3. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 1.8 hertz. Frequency adjustable from 57 hertz to 63 hertz (± 5 percent)

4. The engine-generator set shall be capable of single step load pick up of 100 percent nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

E. The alternator shall produce a clean AC voltage waveform, with not more than five (5) percent total harmonic distortion at full linear load, when measured from line to neutral, and with not more than three (3) percent in any single harmonic.

F. Furnish all necessary electrical connections, transfer switch, control panel, relays, etc., for installation of new generator set.

G. Generator and engine shall be mounted on vibration isolating supports capable of 95 percent isolation to minimize vibration of the remainder of the skid-mounted equipment and transmission of vibration to the supporting pad.

H. Generator shall be fully enclosed or suitably guarded to prevent exposure to all parts which operate at extremely high temperatures, electrically energized, or rotating. All noncurrent carrying parts shall be grounded.

I. Thoroughly clean all equipment, and prime and finish paint with manufacturer's standard paint finish.

J. Outdoor Weather-Protective Housing: Factory-assembled to generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation and exclude entry of moisture into interior components. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer’s standard color.

2.2 ENGINE

A. Engine shall be standby power rated, multi-cylinder, spark ignited four stroke cycle, liquid cooled, internal combustion engine for use with natural gas fuel, industrial type, designed for full rated power output at 1800 rpm, 60 hertz. The engine shall be arranged for direct connection to the alternating current generator.

B. Governor shall be electronic isochronous type no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Random frequency variation shall not exceed ±0.25% of its mean value for constant loads from no load to full load. Governor shall be provided with means for manual operation and adjustment.

C. Lubrication system.
1. Full pressure type with engine driven positive displacement sump pump,
2. Full flow strainer,
3. Full flow filter,
4. Pressure relief and automatic bypass valves,
5. Crankcase ventilator with filter and connection for outside venting,
6. Bayonet type oil level indicating pressure gauges on the upstream and downstream side of the strainer and filter,
7. Drain connection,
8. Oil cooler,
9. Low oil pressure safety shutoff device,
10. Provide water shutoff valves and drain on the oil cooler to facilitate draining water without draining the complete engine cooling system.
11. Provide a radiator coolant level sight glass.

D. Cooling system.

1. Pressure type, with radiator, blower type fan,
2. Engine driven circulating pump,
3. Radiator cap incorporating a pressure-vacuum valve,
4. Thermostat in conjunction with a radiator bypass,
5. Drain connection,
6. High coolant temperature safety device,
7. Fan shall be sized to maintain safe engine temperature in ambient temperature of 120 degrees Fahrenheit,
8. Provide gaskets and packing in the cooling system which are unaffected by ethylene glycol base coolant,
9. Provide a 50% ethylene glycol antifreeze solution for the coolant,
10. Radiators shall be provided with a duct adapter flange permitting the attachment of air discharge duct for directing discharge air through the wall,
11. Radiator and Air Intake/Discharge System Flow Restriction requirement shall be no less than 0.5 inches of water.

E. Provide thermal circulation type engine jacket water heater with integral thermostatic control, sized to maintain minimum coolant temperature of 49 degrees Celsius down to an ambient temperature or 0 degrees Celsius. The heater shall be disconnected whenever the engine starts by an oil pressure switch mounted on engine. Connect heater to 120 volt normal power panel as indicated on Drawings. Install tag at connection on generator to identify power panel and circuit number.

F. Air intake system shall be complete with a dry type filter, and high frequency filter-type silencer for reducing the sound level at the intake to a point acceptable for residential use.

G. Air shutoff for emergency shutdown.

H. Engine exhaust system shall be complete with stainless steel critical type silencer capable of reducing ambient exhaust noise level to 60 dBA when measured 50 feet from the engine under full engine load and clear weather. Silencer shall be supported independently of the engine. Flexible exhaust connection shall be provided from the engine exhaust manifold to the silencer. An exhaust condensation trap with manual drain valve shall be provided to prevent condensation from entering the engine. Furnish and install a steel rain cap at the exhaust stack outlet. Rain cap shall have a high-temp paint finish.

I. Standard SAE nuts, bolts, and studs.

J. Standard NPT or SAE tubing and fittings.

K. Gas Train for Natural Gas Fuel System:
1. General: Provide all fuel system components necessary to allow the generator system to operate under continuous emergency full load. Gas regulator train assembly shall be designed for engine manufacturer's recommended gas pressure from a nominal five (5) pound per-square-inch natural gas service. Install components furnished with engine.
2. Engine-mounted carburetor.
3. Fuel gas pressure regulators with vibration isolating, flexible fuel line joint on gas-supply side.
4. Solenoid valve that automatically shuts off flow of gas if the engine stops for any reason. Install this valve on gas-supply side of gas pressure regulator.
5. Gas pressure gauge with analog display of ounces-per-square-inch to monitor gas supply pressure. Install this gauge in gas train inside the generator set housing.

6. Gas line service regulator with atmospheric vent.
7. Dry filter for vapor withdrawal.
8. Manual shut-off valve.
9. Gas surge tank or other components as may be recommended by engine supplier.
10. Gas fuel line for Emergency Power System shall be connected ahead of the main gas shutoff valve for the building with a separate, dedicated shutoff valve. Mark both generator gas valve and building gas valve with permanent signs to indicate that there is another valve, per NFPA 110, sect. 5-9.7.

2.3 GENERATOR

A. Generator shall be alternating current, three phase, four pole, reconnectible brushless revolving field synchronous type with brushless exciter directly connected to the generator field windings without slip rings or commutators.

B. Generator shall have a single prelubricated sealed bearing, direct connected to the engine, by means of a flexible disc coupling for self-alignment and air cooled by a direct drive centrifugal blower fan.

C. Insulation shall be minimum Class F in a self-ventilated enclosure. Temperature rise shall be 130 degrees Celsius max over ANSI 40 degrees Celsius ambient for standby service.

D. Bring out all leads from each winding to a generator main lead terminal box adequate in size for making up all connections and grounding the neutral to the generator set supporting frame.

E. Voltage regulation shall include True RMS 3 phase sensing, generator-mounted volts per Hertz exciter-regulator to match engine and generator characteristics. Include manual controls to adjust voltage output plus or minus 5 percent of nominal voltage level.

F. The generator shall have the necessary excitation control circuitry to prevent the loss of excitation on fault conditions allowing quick return to full voltage and power to normal and faulted circuits.

G. Furnish NEMA 1 output terminal and outgoing cable termination compartment integral with the engine-generator frame.

H. Output Breakers: Provide output molded case circuit breakers of adequate capacity and rating. Provide output breaker for each output circuit running from generator. Breaker shall be UL Listed 100 percent rated for continuous operation at full ampacity. Provide cable extensions and enclosure required to integrally mount output circuit breaker inside outdoor generator housing. Enclosure shall comply with NEC 404-3.

I. Housing Alternator shall have an open drip-proof construction.

2.4 VOLTAGE REGULATION

A. Static type, three phase, mounted either on the generator control panel or combined with the exciter. Voltage shall have "manual-automatic" switch and be adjustable +/- 10 percent under all operating conditions.

2.5 ELECTRIC STARTING SYSTEM

A. Engine starting system shall be a 12 volt or 24 volt DC system depending on size of engine/generator, consisting of a heavy duty electric cranking motor(s) with drive

mechanism, heavy duty batteries with metal frame or box, engine driven alternator, battery charger, and transistorized voltage regulator.

B. Cranking motor shall be capable of starting the engine five times in rapid succession without overheating the motor and at sufficient speed for starting in low ambient temperatures.

C. Storage batteries shall be lead acid type of voltage and capacity as determined by the engine manufacturer, with sufficient capacity to start the generator set five times consecutively in rapid succession. Provide all battery cables and connections. Provide hydrometer.

D. Battery charger shall be an automatic, self-protected, self-regulated, dual rate rectifier type of a capacity determined by the engine manufacturer and sufficient to automatically recharge the batteries quickly according to the requirements governed by battery discharge duty, and suitable for 120 volt, single phase, 60 hertz input service from a remote receptacle panel.

2.6 ENGINE-GENERATOR CONTROL PANEL

A. Control panel shall be engine generator frame mounted in NEMA 1 enclosure, totally front accessible. Control panel shall be completely factory pre-wired. All external connections shall be wired out to terminal blocks for field wiring. Control panel shall be complete with all engine and generator controls and indicators. Include front hinged double doors with latches and provision for padlock.

B. Control panel shall provide a contact closure to initiate operation of the ventilation system. Wire out to terminal block. Contact shall be field wired by manufacturer as indicated on the Drawings.

C. Control panel shall include the following fully identified by means of permanent nameplates:

1. Control
   a. Output voltage adjustment.
   b. Cranking limiter relay.
   c. Overspeed shutdown.
   d. Low oil pressure shutdown.
   e. High coolant temperature shutdown.
   f. Remote Alarm Contacts: Pre-wired SPST contacts to terminal strip for remote indication of all alarm functions.
   g. Battery operated service light to illuminate panel during power outage conditions.
   h. Manual-off-auto engine start switch.
2. Visual monitoring
   a. Frequency Meter: 45-65 Hz range, 3½ inch (89 mm) dial.
   b. AC Output Voltmeter: 3½ inch dial, two (2) percent accuracy, with phase selector switch (phase-to-phase and phase-to-ground).
   c. AC Output Ammeter: 3½ inch dial, two (2) percent accuracy, with phase selector switch and 3 current transformers.
   d. Push-to-test indicator lamps, one for each:
      1) Engine run
      2) Low oil pressure
      3) High water temperature
      4) Overspeed and overcrank
      5) Overspeed shutdown
      6) Failure to crank
      7) Failure to establish voltage or frequency.

8) Failure to reach rated voltage at transfer switch in ten (10) seconds

e. Engine running time meter.
f. Electrical oil pressure gauge.
g. Electrical water temperature gauge.
h. Mechanical fuel pressure gauge.
i. Radiator sight glass.
j. DC voltmeter and ammeter.

3. Audible monitoring
   a. Low oil pressure alarm condition.
   b. High coolant temperature alarm.
   c. Failure to crank.
   d. Failure to establish voltage or frequency.
   e. Failure to reach rated voltage at transfer switch in ten (10) seconds.

D. Battery charging system including alternator and solid state regulator.

E. Remote Annunciator NFPA 110: Provide a remote annunciator to meet the requirements of NFPA 110, Level 1. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn. Locate annunciator in the Administration Area per owner's instruction.

2.7 WEATHER PROTECTIVE ENCLOSURE

A. Standard Enclosure:
   1. Steel weather protective enclosure with 14 gauge sheet metal and a minimum ambient capability of 43 degrees Celsius (110 degrees Fahrenheit). Shall have removable, and / or hinged doors and removable end panels to allow easy routine maintenance. All hinges and latches shall be rust resistant and doors shall be equipped with rubber seals. A lockable service access cover shall be provided for easy access to the radiator fill cap. The enclosure shall be painted utilizing electrostatically applied powder baked paint.

2.8 AUTOMATIC TRANSFER SWITCHES

A. Furnish and install automatic transfer switches (ATS) with four (4) poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

B. Acceptable Manufacturers:
   1. ASCO
   2. Russ Electric
   3. Zenith
   4. Kohler
   5. Cummins/Onan

C. Mechanically Held Transfer Switch
   1. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.

2. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
3. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
6. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

D. Microprocessor Controller
1. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.
2. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1 percent of nominal voltage. Frequency sensing shall be accurate to ± 0.2 percent. The panel shall be capable of operating over a temperature range of -20 to +60 degrees Celsius and storage from -55 to +85 degrees Celsius.
3. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator’s manuals.
4. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
5. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
   a. EN 55011:1991 Emission standard - Group 1, Class A
   b. EN 50082-2:1995 Generic immunity standard, from which:
      1) EN 61000-4-2:1995 Electrostatic discharge (ESD) immunity
      2) ENV 50140:1993 Radiated Electro-Magnetic field immunity
      3) EN 61000-4-4:1995 Electrical fast transient (EFT) immunity
      4) EN 61000-4-5:1995 Surge transient immunity
      5) EN 61000-4-6:1996 Conducted Radio-Frequency field immunity
   c. IEEE472 (ANSI C37.90A) Ring Wave Test.

E. Enclosure
1. The ATS shall be furnished in a Type 3RX enclosure unless otherwise shown on the plans.

F. Controller Display and Keypad
1. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:
   a. Nominal line voltage and frequency
   b. Single or three phase sensing
   c. Operating parameter protection
   d. Transfer operating mode configuration
      (Open transition, Closed transition, or Delayed transition)

   All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

G. Voltage, Frequency and Phase Rotation Sensing
1. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E,3ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

2. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20°C to 60°C.
3. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
4. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).
5. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

H. Time Delays
1. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
3. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable

from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
5. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:
   a. Prior to transfer only.
   b. Prior to and after transfer.
   c. Normal to emergency only.
   d. Emergency to normal only.
   e. Normal to emergency and emergency to normal.
   f. All transfer conditions or only when both sources are available.

I. Additional Features
1. A three position momentary-type test switch shall be provided for the test / automatic / reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.
2. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
3. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.
4. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
5. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
   a. The following features shall be built-in to the controller, but capable of being activated through keypad programming or the serial port only when required by the user:
      1) Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
      2) Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.
      3) An Inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.

J. Engine Exerciser: The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:
1. Enable or disable the routine.
2. Enable or disable transfer of the load during routine.
3. Set the start time,
   - time of day
   - day of week
   - week of month (1st, 2nd, 3rd, 4th, alternate or every)
4. Set the duration of the run.
   At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

K. Withstand and Close-On Ratings
1. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.
2. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

L. Tests and Certification
1. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

M. Service Representation
1. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

2.10 AUTOMATIC TRANSFER SWITCHES WITH BYPASS SWITCH

A. Automatic transfer switch with bypass switch shall conform to all requirements of Section 2.9 Automatic Transfer Switch subsections B. to M.

B. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.

C. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control inter-wiring shall be provided with disconnect plugs.

D. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

E. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

F. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

G. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch. G. Designs requiring operation of key interlocks for bypass isolation or ATS which cannot be completely withdrawn when isolated are not acceptable.

2.11 MANUAL TRANSFER SWITCH WITH DOCKING

A. Furnish and install a transfer switch equipped with a means to connect a load bank to the generator and a temporary generator to the associated ATS, male cam-style inlet connectors, female cam-style outlet connectors, power distribution blocks and grounding terminals, all housed within a padlockable enclosure. An interlock means shall be provided that shall prevent the simultaneous connection of both the temporary and permanent generator to the associated ATS.

B. Acceptable Manufacturers:
   1. ASCO
   2. Russ Electric
   3. Zenith
   4. Kohler
   5. Cummins/Onan
   6. ESL Power Systems

C. Enclosure
   1. The MTS shall be furnished in a Type 3RX enclosure unless otherwise shown on the plans.

D. Cam-style male connectors (inlets) and cam-style female connectors (outlets) shall be UL Listed single-pole separable type and rated 400 amps at 600VAC. All cam-style connectors shall be color coded. Cam-style connectors shall be provided for each phase and for ground, and shall also be provided for neutral. Each of the phase cam-style connectors and the neutral cam-style connectors within the enclosure shall be factory-wired to a molded case circuit breaker. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor. None of the cam-style connectors shall be accessible unless all (3) molded case circuit breakers are in the “OFF” position and the main access door is open.

E. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.

F. Molded case circuit breakers if used shall be UL Listed 4-pole and the short circuit interrupt rating shall be a minimum of 35kAIC at 480VAC (wall mount units) or 50kAIC at 480VAC (pad mount units).

G. An auxiliary contact shall be provided in the circuit breaker controlling the connection from the Permanent Generator to the ATS and shall be factory wired to terminal blocks within the enclosure. The auxiliary contact is provided in compliance with NEC 2017 700.3 (F)(5) which requires a means to activate an annunciator circuit.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide all work required for a complete system, including complete system testing and checkout. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.

3.2 EMERGENCY DISTRIBUTION SYSTEM

A. All boxes, and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system. Emergency circuits shall be specially marked and shall be run in raceway separate from normal powered circuits. All distribution equipment shall be specifically indicated "EMERGENCY" on the equipment nametag. Color code for emergency markings and all nametags shall be RED.

3.3 COMMISSIONING SERVICE

A. A final inspection and an initial startup of the system shall be rendered by the authorized factory representatives.

B. A letter of certification written by the authorized factory representatives, which states that the system is properly installed and does properly function as recommended by the factory and as described in this specification, shall be submitted to the Architect for his approval.

C. A test run shall be performed by the authorized factory representative in the presence of the Owner, Architect and Engineer; the time of this test run shall be mutually agreed upon by all persons concerned. This test run may, but is not required to, coincide with other testing requirements described in this section.

3.4 INSTALLATION

A. General: Provide all labor required for a complete installation.
B. Mounting: Anchor on a four (4) inch concrete pad with bolts and elasto-rib vibration isolators. Pad shall extend a minimum of 18 inches from each side of the generator set skid.

3.5 CONSUMABLES

A. Refuel during testing as required. After all tests have been performed, fuel tanks shall be filled before system is accepted by Owner. Check oil, coolant, batteries, filters and other consumables. Top off and replace as necessary to leave engine-generator set at full capacity for all consumables.

3.6 TESTING

A. Factory Testing: The engine generator shall be tested at the factory, demonstrating its performance at full rated load. A certified copy of the test report shall accompany the unit to the field and shall be made available to the building official and copied to the Architect and Engineer.

B. Field Testing: Conduct tests of the system as required by NEC Article 700 in the presence of the Owner, Architect, Engineer, and Code Authority having jurisdiction. The engine generator set shall demonstrate the actual sequencing of all load onto the generation unit and shall carry the building emergency loads, including any elevator(s), for a minimum period of two (2) hours. Contractor shall insure that all emergency loads are operational before scheduling this test. Test times shall be mutually agreed upon by all persons concerned.

3.7 SYSTEM GROUNDING

A. The emergency power system generator output shall be grounded as a separately derived system according to the requirements of the Section titled GROUNDING. Bond the generator neutral to the generator ground.

3.8 SIGNS

A. Refer to Section 16075, Electrical Identification for Sign Requirements.

B. Service Entrance: A sign shall be placed at the normal power service entrance indicating location of the emergency power engine-generator set.

C. Generator: Provide a sign arranged to be prominent and legible at the set control panel. Sign shall be an OSHA orange WARNING sign plus text. Sign text shall be "Warning - This equipment starts automatically. Disconnect all sources of supply and load before servicing", or similar approved text.

D. Fuel Tank: Provide a "Caution - No Smoking" sign on the housing. Sign shall be an OSHA yellow caution sign with text and graphic no-smoking symbol. Provide sign per NFPA 110 Sect. 5.9.7 at both generator gas shut-off valve and building gas shut-off valve to indicate that there is another valve.

3.9 REMOTE WIRING

A. General: Provide raceway, wiring and control cables from generator control panel to remote points. Underground conduits may be direct buried without concrete encasement if a red plastic warning tape is installed above each conduit.

B. Remote Points:
1. Engine-Generator Remote Panel
2. Automatic Transfer Switches
3. Automatic Battery Charger. Provide dc wiring from remote charger to battery rack at engine-generator set. Size wire for maximum 2 percent dc voltage drop at full load.

4. Generator control power 120V branch circuit.
5. Engine water jacket heater branch circuit.
6. Outdoor generator housing: battery rack warming jacket 120V branch circuit.
7. Outdoor generator housing: generator strip heater 120V branch circuit. One circuit may serve both jacket heater and generator heater if total load including voltage drop is less than 80% circuit ampacity.
8. Elevator Controllers; (Signals shall be taken from ATS).
9. Building Automation System (BAS); (BAS wires to the ATS).
10. Building Security System
11. Emergency Lighting Automatic Transfer Switches

3.10 EMERGENCY LIGHTING AUTOMATIC TRANSFER SWITCHES

A. Provide automatic slave transfer switches where indicated on the drawings for transfer of dimmer branch circuits utilized for emergency lighting.

END OF SECTION 26 32 13

SECTION 26 43 00 - SURGE PROTECTION DEVICES (SPDs) FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Section 16400 – Surge Protection Devices, individually mounted and switchboard mounted. Switchboards: Surge Protection Device integrated in switchboards.

1.3 REFERENCES

A. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,

B. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,

C. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.

D. National Electrical Code: Article 285

E. UL 1283 - Electromagnetic Interference Filters

F. UL 1449, Third Edition, effective September 29, 2009 – Surge Protection Devices

1.4 SUBMITTALS

A. Product Data: Submit capacity, dimensions, weights, details, and wiring configuration.

B. Submittals shall include UL 1449 4th Edition Listing documentation verifiable by visiting www.UL.com, clicking “Certifications” link, searching using UL Category Code: VZCA and VZCA2:
   1. Short Circuit Current Rating (SCCR)
   2. Voltage Protection Ratings (VPRs) for all modes
   3. Maximum Continuous Operating Voltage rating (MCOV)
   4. I-nominal rating (I-n)
   5. SPD shall be UL listed and labeled as Type 1 or Type 4 intended for Type 1 or Type 2 applications.

C. Upon request, an unencapsulated but complete SPD formally known as TVSS shall be presented for visual inspection.

D. Minimum of ten (10) year warranty Manufacturer's Installation Instructions: Submit installation instructions and connection requirements.

1.5 QUALITY ASSURANCE

A. List individual units under UL 1449 (Forth Addition) and UL 1283.

B. Single manufacturer: All equipment of each type shall be the product of one manufacturer.

C. SPD shall comply with NEC Article 285 and shall be permanently marked with the short-circuit current rating of the device.

D. Manufacturer Qualifications: Engage a firm with at least 5 years experience in manufacturing transient voltage surge suppressors.

E. Manufacturer shall be ISO 9001 or 9002 certified.

F. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

G. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in factory packaging. Inspect for damage.

B. Protect equipment from damage by providing temporary covers until construction is complete in adjacent space.

C. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 SURGE PROTECTION DEVICES (SPDs)

A. Manufacturers:
1. Current Technology
2. Southern Tier Technology
3. Siemens
4. Square D
5. GE

B. Product Description: Surge protection devices for protection of AC electrical circuits.

C. Unit Operating Voltage: As indicated on Drawings.

D. Construction:
1. Finish: Factory finish of baked enamel.
2. Balanced Suppression Platform: Equally distribute surge current to Metal Oxide Varistor (MOV) components to ensure equal stressing and maximum

performance. Furnish surge suppression platform with computer matched +/1% MOV for equal load share.

3. Internal Connections: Hardwired with connections using low impedance conductors and compression fittings.
4. Safety and Diagnostic Monitoring: Equipped with standard overcurrent protection:
   a. Continuous monitoring of fusing system.
   b. Monitor individual MOV's (including neutral to ground). Capable of identifying open circuit failures not monitored by conventional fusing systems.
   c. Monitor for overheating in each mode due to thermal runaway.
   d. Furnish green and red solid state indicator light on each phase. Absence of green light and presence of red light indicates which phases have been damaged. Fault detection activates flashing trouble light. Units not capable of detecting open circuit damage, thermal conditions, and over current will not be accepted.
5. Labeling: Permanently affix UL 1449 (Forth Addition) suppression voltage ratings and CSA to unit.

E. Types:
1. Switchboards; locate as integral part of switchboard, coordinate mounting with switchboard manufacturer.
2. Panelboards; locate as stand-alone. Component in housing adjacent to protected panelboard. Install less than 10ft from the panel with minimum bends in the wire.

F. Protection Modes: For Wye configured system, furnish device with directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For Delta configured system, furnish device with suppression elements between line to line (L-L) and line to ground (L-G).

G. Swithboards:
1. The SPD shall be UL 1449 labeled as Type 1 or as Type 4 intended for Type 1 or Type 2 applications.
2. SPD shall meet or exceed the following criteria:
   a. Maximum 7-Mode surge current capability shall be 300kA per phase.
   b. UL 1449 – 4th Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-G	L-L	MCOV
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

3. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/347	15%	320V

4. SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz.
5. Suppression components shall have redundant protection designed to share surge currents.
6. SPD shall include a serviceable, replaceable module.
7. SPD shall be equipped with the following diagnostics:

a. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
b. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
c. Form C dry contacts one normally open (NO) and one normally closed (NC) for remote status monitoring.
d. Surge Counter

No other test equipment shall be required for SPD monitoring or testing before or after installation.

8. SPD shall have a response time no greater than 1/2 nanosecond.
9. SPD shall have a 10 year warranty.

H. Distribution and Lighting Panelboards:

1. Listing requirements: SPD shall bear the UL Mark and shall be Listed to most recent editions of UL/ANSI 1449 and UL 1283. “Manufactured in accordance with” is not equivalent to UL listing and does not meet the intent of this specification.
2. Listing requirements: SPD and performance parameters shall be posted at www.UL.com under Category Code: VZCA. Products or parameters without posting at UL.com shall not be approved. (To access UL Category Code click on Certifications in the left menu bar of UL’s home page. Type “VZCA” into the Category Code search box and click Search.)
3. SPD shall be UL 1449 labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
4. SPD shall be UL 1449 labeled as Type 1 intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
5. SPD shall be UL 1449 labeled with 20kA I-nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
6. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems
7. If a dedicated breaker for the SPD is not provided in the switchboard, the service entrance SPD shall include an integral UL Recognized disconnect switch. A dedicated breaker shall serve as a means of disconnect for distribution SPD’s.
8. SPD shall meet or exceed the following criteria:
9. Minimum surge current capability (single pulse rated) per phase shall be:
   a. Distribution applications:
      1) Southern Tier Technologies T45XXXX050AWAJ2C with Maximum surge current capability of 100kA per phase

10. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

VOLTAGE	L-N	L-G	N-G
208Y/120V	700V	700V	700V
480Y/277V	1500V	1500V	1500V

UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V

480Y/277V	20%	320V

11. SPD shall include a serviceable, replaceable module (excluding Distribution). (Deletable note: Delete or adjust as appropriate.)
12. Service Entrance ul Type 2 devices SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.
13. SPD shall have a warranty for a period of ten (10) years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.
14. SPDs shall be equipped with the following diagnostics:
    a. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
    b. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
    c. Form C dry contacts one normally open (NO) and one normally closed (NC) for remote status monitoring.
    d. Surge Counter

No other test equipment shall be required for SPD monitoring or testing before or after

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify mounting area is ready for equipment.

B. Verify circuit rough-ins are at correct location.

3.2 INSTALLATION

A. Install in accordance with IEEE 1100.

B. Install service entrance suppressors in switchboard.

C. Install suppressors for panelboards adjacent to panel.

D. Install surge counter in face of switchboard.

E. Include surge counter for stand-alone SPD.

F. Install with maximum conductor length of 24 inches. Install suppressor with internal fusing.

G. Provide 30 amp, 3 pole circuit breaker in panelboards to feed SPD.

END OF SECTION 26 43 00

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories. Provide all luminaries complete with all new lamps, completely wired, controlled, and securely attached to supports.

1.3 SUBMITTALS

A. Product Data: Submit dimensions, ratings, and performance data.

B. Photometric data for each luminaire, lamp and ballast. Include indications of all options and accessories as well as finish color.

C. Specification Review: A complete item by item, line by line specification review.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Provide luminaires listed by U.L.
2. Luminaires installed in outdoor areas unprotected from weather to be U.L. Listed for wet locations.
3. Insulated ceilings: Luminaires installed into insulated ceilings shall be U.L. Listed Type IC.

B. Certification: Certify that fixtures submittal have trim compatible with ceilings being installed.

C. Concrete for outdoor lighting poles foundations shall be provided per Section 03 30 00 - Concrete.

1.5 EXTRA MATERIALS

A. Attic stock for light fixtures and LED drivers: Attic stock shall be boxed in OEM sealed packaging and boxes and clearly labeled for contents. Large quantiles of the same item boxes may be palletized and shrink wrapped, and clearly labeled on the outside of the shrink wrap, stored as directed by LCISD.

B. Exterior light fixtures and parking lot pole mounted light fixtures: For each light fixture type, furnish two percent, a minimum of two to a maximum of 25 complete light fixture assemblies and a quantity of 50 individual component LED drivers and LED chip arrays.

C. Interior light fixtures: For each light fixture type, furnish two percent, a minimum of two to a maximum 25 of complete light fixture assemblies and quantity of 50 individual component LED drivers.

D. Exit light fixtures: For each exit light fixture type, furnish a minimum of two and a maximum of 10-percent of complete light fixture assemblies and also the same quantity of individual component LED drivers. Provide complete installation of intended attic stock exit signs as directed by the AHJ for certificate of occupancy or otherwise directed by the Architect/Engineer. Attic stock exit signs not required to be installed shall remain the property of LCISD as boxed attic stock.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Acceptable Manufacture: Provide per Fixture Schedule on drawings.

1. Approved equal: Contractor may submit luminaires from other manufacturers. Contractor shall provide a full set of submittals per paragraph 1.2 of this specification section for Engineer and Architects approval. Contractor must have approved submittals stamped and dated from the Engineer and Architect minimum 10 days prior to bid.

B. Product Description: Complete luminaire assemblies, with features, options, and accessories as scheduled.

C. All luminares shall be new and of specification grade.

D. Manufacturer nomenclature in fixture schedule or otherwise described on the Drawings is given only to show the general fixture series. Contractor shall provide fixture with all required accessories and mounting frame type.

E. Wire guard at fixtures in mechanical, electrical, and high abuse areas.

2.2 LED LUMINAIRES

A. Quality Assurance
1. DOE Lighting Facts certified.

B. LED Specifications
1. Lumen maintenance of the LEDs has been tested in accordance with IESNA LM-80-08 reporting methodology.
2. CRI:>82 minimum (general); >90 healthcare and retail.
3. SDCM: <2.5 in linear pendants and linear recessed; <3.5 in discrete recessed.
4. R9: .0 (general office/school environments); >50 in healthcare and retail environments.
5. Outdoor luminaires to be rated at a minimum of 40^0 C.

C. Lumen Maintenance
1. Minimum L70 at 50K hours based on TM-21 Addendum A Lifetime report at an ambient temperature of 25^0 C, outdoors at an ambient temperature of 40^0 C.

D. Thermal Testing
1. ISTM testing in accordance to UL 1598-2008.

E. Driver
1. 0-10V enabled.
2. Output Class 2 rated.
3. Dimming range: 5-100%.
4. Constant current.
5. THD @ max load: <20%.
6. Power factor: >0.95
7. Environment protection rating: UL Damp and dry.
8. Approbations: certified to UL8750, UL1310, UL935, CSA-C22.2 No. 250.13-12, CSA 22.2 No. 223.
9. ROHS Compliant

F. Fixture photoetry
1. Conducted by a NVLAP accredited testing lab with IESNA LM 79-08.
2. System flux measured in delivered lumens.

G. Warranty
1. 5 year total system warranty.

2.3 EMERGENCY BATTERY PACKS

A. Provide Emergi-Lite FPSIU series, or approved equal, battery pack for fluorescent fixtures designated to have emergency battery back-up.

B. Fixture shall include lighted push button test switch installed in visible, accessible location adjacent to fixture.

C. Provide unswitched alternating current power source per manufacturer's instructions.

D. Provide connection to local switch where indicated on drawings, connect such that fixture can be controlled on/off from local switch without discharge of battery.

E. For fixtures designated to have emergency battery pack and be on a contactor controlled circuit, provide unswitched alternating current source ahead of contactor and wiring as required to allow automatic on/off control from the contactor without discharge of battery and local on/off switching where indicated.

F. Battery pack shall provide 1100 lumen output for 90 minutes per 2'x4' light fixture.

G. Provide integral battery pack for all exit signs where emergency generator power is not available. Battery pack shall provide minimum of 90 minutes output.

2.4 EMERGENCY LIGHTING AUTOMATIC TRANSFER SWITCHES

A. Provide automatic transfer switch on all lighting fixtures shown to be on emergency.

2.5 DOWNLIGHT FIXTURES

A. Provide recessed light fixtures with trim rings compatible with the ceiling material where fixture is to be installed.

2.6 EXIT SIGNS

A. Exit signs shall meet visibility requirements and be listed per UL 924 " Emergency Lighting and Power Equipment". Also shall meet Federal, State and Local Codes.

B. Chevron Directional Indicator: Provide Chevron per NFPA 101 Section 5-10.4.1.2.

C. Product Description:
   1. LED Exit Sign:
      a. Provide exit sign with Light Emitting Diodes (LED) illuminance source. Cover LED with diffuser.

D. Housing: Diecast aluminum with stencil face and matte white paint finish.

E. Input Voltage: 120/277 volt, dual input voltage.

F. EPA Energy Star Label.

G. Wire Guards: Install wire guard on all exit signs installed in gyms, lockers rooms, and athletic wing.

2.7 OUTDOOR LUMINAIRE POLE ASSEMBLIES

A. Outdoor Pole assemblies shall consist of a pole base, pole, luminaire or group and lighting circuit wiring.

B. Diesel Standard: 2000 (IBC) International Building Code. Section 1609 requires wind forces on structure to be determined by the provisions of ASCE 7.

C. Minimum Wind Speed: 120 miles per hour.

D. Metal poles shall comply with NEC 410-15(b).

E. Pole Material: Steel.

F. Pole Shape: Round tapered.

G. Pole finish shall match luminaires along mounting arms and bolt covers. Provide polyester powder coat finish on pole and luminaire, 3 mil thick.

H. Pole accessories to include handhole and cover, full matching anchor bolt cover, anchor bolt kit, template, washers and leveling nuts.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned luminaires, lamps, poles and accessories.

B. Extend existing luminaire installation using materials and methods compatible with existing installation, or as specified.

C. Clean and repair existing luminaires to remain or to be reinstalled.

3.2 INSTALLATION

A. General: All luminaires shall have proper supports.

B. Install suspended luminaires using pendants supported from swivel hangers.

C. Locate recessed ceiling luminaires as indicated on Drawings.

D. Install surface mounted ceiling luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Chain Hung: Unless otherwise indicated all fluorescent fixtures in Mechanical, Electrical and Elevator Equipment Rooms shall be chain hung. Verify exact mounting height with Architect before installing fixtures. Provide pendant hangers when equipment room has fire-resistive ceiling.

F. Suspended Ceilings:
1. Provide means of support for luminaires per NEC 410-36. T-bar clips shall be installed on the luminaire and shall be field secured to the inverted ceiling tees so that the luminaire is securely fastened to the ceiling system framing members.
2. Ceiling tiles shall not bear the weight of luminaires. Surface mount luminaires, recessed downlights, light track, exit signs, etc. shall be supported by proper frames or other attachment to main ceiling system grid or building structure above ceiling.
3. Luminaires shall be centered in ceiling tile.
4. Luminaire shall have flange or trim ring for closure of ceiling cutout or opening.
5. Fire-rated Ceiling Assembly: For Luminaires to be flush-mounted into a fire-rated ceiling or surface mounted to a fire-rated ceiling, install with independent, secure support. Raceway, cable assemblies, boxes and fittings located above a fire-rated floor/ceiling or roof ceiling assembly shall not be secured to, or supported by, the ceiling assembly including the ceiling support wires. Provide an independent means of secure support. Independent support wires shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

G. Verify weights and recommended mounting methods of all luminaires with manufacturers. Furnish and install supports. Luminaires weighing more than 30 pounds shall be supported independently of the outlet box.

3.3 LOCATIONS

A. Luminaires shown on the Electrical Drawings represent general arrangements only. Refer to Architectural Drawings and to Architect on jobsite for more exact locations. Coordinate location with all other trades before installation. Coordinate all light fixtures in Mechanical Rooms with the final installed piping and ductwork layouts. Adjust fixture mounting height and location if required so that light output is not obstructed by piping and ductwork.

3.4 FIRE INTEGRITY OF CEILING PENETRATIONS

A. Where ceiling is part of a fire-rated assembly, maintain integrity of that assembly with methods given in Section Electrical Hangers and Supports. Obtain ceiling system UL Fire Resistance Directory Design Number from Architectural Drawings.

3.5 AIMING AND ADJUSTMENT

A. General: All adjustable lighting units shall be aimed, focused, and locked by the Contractor under the supervision of the Architect/Owner. All aiming and adjusting shall be carried out after the entire installation is complete.

CLEANING

A. Lens: Clean lenses of all luminaires after space is finished and prior to project acceptance.

B. Louvers: Remove plastic bag from parabolic louver luminaires after space is finished and prior to project acceptance. Do not remove bags until luminaires have been cleared by the air-balance subcontractor.

3.6 OUTDOOR LUMINAIRE POLES

A. Pole Base: Do not grout space between pole base plate and top of concrete pole foundation. Leave open to allow water to drain and for pole to breathe. If grout is recommended by pole manufacture in space between pole base plate and top of concrete pole foundation, provide grout with drain hole through grouting.

B. Pole Delivery: Unwrap pole upon delivery to job site, unless otherwise instructed by pole manufacturer. Wrapped poles exposed to weather that show wrapper striping or other deterioration of finish shall be replaced at Contractor expense. Replacement shall be new pole or pole refinished at pole factory.

C. Installation:
1. Poles shall be erected only with luminaire(s) or equivalent damping device, unless otherwise instructed by pole or luminaire manufacturer. Poles installed without luminaires are subject to increased modes of vibration.
2. Do not level pole with shims; leveling nuts above and below pole baseplate provide flexible adjustment and long-term holding of pole position.
3. Provide anchor bolts and pole manufacturer's bolt template prior to concrete formwork for pole bases.
4. Minimum wire size for circuit tap inside pole shall be AWG #12.
5. Install pole base cover. Cover shall rest on top of concrete pole foundation and completely conceal air space under pole base plate.

D. Fusing:
1. Install fuse holder and fuses as noted in pole base detail on Drawings.
2. All ballast-controlled luminaires shall be protected by Bussmann Fuses FNQ with Holders HEB (1-pole) or (2-pole) HEX. Fuse(s) and holder shall be mounted inside pole at handhole. Size of fuse to be recommended by the luminaire manufacturer.

3.7 RFI

A. Provide flexible braided metal electrical bonding strap from grounded housing to door frame of all fluorescent parabolic fixtures in designated rooms. Bonding strap shall be braided conductor designed for field installation to either long door side.

END OF SECTION 26 50 00

SECTION 27 00 00 - BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 RELATED WORK

A. The entire drawing and specification package apply to the work specified in the telecommunications sections of the specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.02 SCOPE OF WORK

A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.

B. It is the intent of the Contract Documents to provide an extension of the existing installed systems interfaced with new systems, complete in every respect.

C. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the Engineer of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.

D. Provide line-by-line specification review for each Division 27 section annotated to certify compliance or deviation.

1.03 DRAWINGS AND SPECIFICATIONS

A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.

B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Engineer for review. No departures shall be made without prior written acceptance of the Engineer.

C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Engineer in writing, shall be performed or furnished. In case the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large scale details govern small scale drawings.

D. Items specifically mentioned in the specifications but not shown on the drawings and/or items shown on the drawings but not specifically mentioned in the specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

1.04 CODES AND STANDARDS

A. All work shall comply with the applicable articles of the National Electrical Code, the National Electrical Safety Code, the National Fire Codes (published by National Fire Protection Association), and City Codes and Ordinances, as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations, or requirements of these authorities.

B. Contractor is responsible for knowledge and application of current versions of all applicable standards and codes. In cases where listed standards and codes have been updated, Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

C. ANSI/TIA:

1. ANSI/TIA-526-7-A (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
2. TIA-526.2-A (July 2015) Effective Transmitter Output Power Coupled into Single-Mode Fiber Optic Cable - Adoption of IEC 61280-1-1 ed. 2 Part 1-1: Test Procedures for General Communication Subsystems – Transmitter Output Optical Power Measurement for Single-Mode Optical Fiber Cable
3. ANSI/TIA-4994 (March 2015) Standard for Sustainable Information Communications Technology
4. ANSI/TIA-526-14-C (April 2015) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
5. ANSI/TIA-568.0-D (September 2015) Generic B (supersedes TIA-568-C.0 and TIA-568-C-1)
6. ANSI/TIA-568.1-D (September 2015) Commercial Building Telecommunications Infrastructure Standard (supersedes ANSI/TIA-C.1)ANSI/TIA-568.2-D (September 2018) Balanced Twisted-Pair Telecommunications Cabling and Components Standard
7. ANSI/TIA-568.3-D (June 2016) Optical Fiber Cabling Components Standard
8. ANSI/TIA-568.4-D (August 2020) Broadband Coaxial Cabling Components Standard
9. ANSI/TIA-569-E (May 2019) Telecommunications Pathways and Spaces
10. ANSI/TIA-598-D (July 2014) Optical Fiber Cable Color Coding
11. ANSI/TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
12. ANSI/TIA-606-C (June 2017) Administration Standard for Telecommunications Infrastructure
13. ANSI/TIA-607-D (July 2019) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
14. ANSI/TIA-758-B (March 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
15. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems
16. ANSI/TIA-942-B (July 2017) Telecommunications Infrastructure Standard for Data Centers
17. ANSI/TIA-1005-A (May 2012) Telecommunications Infrastructure Standard for Industrial Premises
18. ANSI/TIA-1005-A-1 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises, Addendum 1- M12-8 X-Coding Connector - Addendum to TIA-1005-A
19. ANSI/TIA-1183 (August 2012) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
20. ANSI/TIA-1183-1 (January 2016) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183

21. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
22. TIA-1179-A (September 2017) Healthcare Facility Telecommunications Infrastructure Standard
23. ANSI/TIA-4966 (May 2014) Telecommunications Infrastructure Standard for Educational Facilities
24. TIA-455-104-B (February 2016) FOTP 104- Fiber Optic Cable Cyclic Flexing Test (supersedes TIA-455-104-A)
25. TIA/EIA-455-25-D (February 2016) FOTP-25 Impact Testing of Optical Fiber Cables
26. TIA-604-18 (November 2015) FOCIS 18 Fiber Optic Connector Intermateability Standard – Type MPO-16
27. TIA-604-5-E (November 2015) FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO
28. TIA-5017 (March 2016) Telecommunications Physical Network Security Standard
29. TIA-TSB-155-A (Reaffirmed 10-6-2014) Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T
30. TSB-184 (July 2009) Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
31. TSB-4979 (August 2013) Practical Considerations for Implementation of Multimode Launch Conditions in the Field
32. TSB-190 (June 2011) Guidelines on Shared Pathways and Shared Sheaths
33. TIA-TSB-162-A (November 2013) Telecommunications Cabling Guidelines for Wireless Access Points
34. TSB-5018 (July 2016) Structured Cabling Infrastructure Guidelines to support Distributed Antenna Systems
35. TIA-492AAAE (June 2016) Detail Specification for 50-µm Core Diameter/125-µm Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers with Laser-Optimized Bandwidth Characteristics Specified for Wavelength Division Multiplexing
36. TIA-492AAAB-A (November 2009) Detail specification for 50-µm core diameter/125-µm cladding diameter class Ia graded-index multimode optical fibers
37. TIA-455-243 (March 2010) FOTP-243 Polarization-mode Dispersion Measurement for Installed Single-mode Optical Fibers by Wavelength-scanning OTDR and States-of-Polarization Analysis
38. TSB-172-A (February 2013) Higher Data Rate Multimode Fiber Transmission Techniques

D. ISO/IEC:

1. ISO/IEC TR 11801-99-01 Information technology – Generic cabling for customer premises: Guidance for balanced cabling in support of at least 40 GBit/s data transmission: Parts 1 and 2
2. ISO/IEC TR 29106 AMD 1 Information technology -- Generic cabling -- Introduction to the MICE environmental classification
3. ISO/IEC 24764 AMD 1 Information technology – Generic cabling for data centers
4. ISO/IEC 11801 AMD 1 AMD 2 Information technology – Generic cabling for customer premises
5. ISO/IEC 15018 AMD 1 Information technology – Generic cabling for homes
6. ISO/IEC 24702 AMD 1 Information technology – Generic cabling – Industrial premises
7. ISO/IEC 14763-1 AMD 1 Information technology – Implementation and operation of customer premises cabling – Part 1: Administration
8. ISO/IEC 14763-2 Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation
9. ISO/IEC 14763-2-1 Information technology – Implementation and operation of customer premises cabling – Part 2-1: Planning and installation – Identifiers within administration systems

10. ISO/IEC 14763-3 Ed 2.0 Information technology -- Implementation and operation of customer premises cabling -- Part 3: Testing of optical fiber cabling
11. ISO/IEC TR 24704 Information technology – Customer premises cabling for wireless access points
12. ISO/IEC TR 24750 Information technology – Assessment and mitigation of installed balanced cabling channels in order to support 10GBASE-T
13. ISO/IEC TR 29125 IT Telecommunications cabling requirements for remote powering of terminal equipment

E. BICSI – Building Industry Consultative Services International – Published Standards
1. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
2. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
3. ANSI/BICSI-003-2014 Building Information Modeling (BIM) Practices for Information Technology Systems
4. BICSI 004-2012, Information Technology Division Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
5. ANSI/BICSI 005-2016, Electronic Safety and Security (ESS) System Design and Implementation Best Practices
6. BICSI 006-2015 Distributed Antenna System (DAS) Design and Implementation Best Practices
7. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
8. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
9. BICSI – Building Industry Consultative Services International – Manuals
10. Telecommunications Distribution Methods Manual, 14th Edition (2020)
11. Information Transport Systems Installation Methods Manual (ITSIMM), 6th Edition
12. Outside Plant Design Reference Manual, 5th Edition
13. BICSI's ICT Terminology Handbook, Version 1.0
14. Telecommunications Project Management Manual (TPMM), 1st edition
15. Telecommunications Project Management Reference Document (TPMRD), 2nd Edition
16. BICSI's Special ICT Design Considerations, Version 1.0
17. Essentials of Bonding and Grounding, Version 1.0

F. National Electric Codes
1. National Electrical Safety Code (NESC) (IEEE C2-2012)
2. NFPA 70-2020, National Electrical Code© (NEC©)
3. ANSI/IEEE C2-207, National Electrical Safety Code®
4. National Electrical Code (NEC) (NFPA 70)
5. NFPA 72 National Fire Alarm and Signaling Code

G. ASHRAE
1. ASHRAE Standard 90.4P, Energy Standard for Data Centers and Telecommunications Buildings

H. OSHA Standards and Regulations – all applicable

I. Local Codes and Standards – all applicable

J. Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.

K. Knowledge and execution of applicable standards and codes is the sole responsibility of the

Contractor.

L. Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense.

M. In any instance where these Specifications call for materials for construction of a better quality or larger size than required by the codes, the provisions of these Specifications shall take precedence. The codes shall govern in case of direct conflict between the Codes and the Drawings.

1.05 EXISTING UTILITIES

A. The Contract Documents reflect the general location and routing for all telecommunications services known to exist on this project.

1.06 BUILDING CONSTRUCTION AND LAYOUT OF WORK

A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.

B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes and ordinances as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate conduit hangers shall be set before concrete is poured, and proper openings through floors, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required before concrete is poured. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Engineer. The Engineer reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.

D. In areas of existing special ceiling construction the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.

PART 2 – PRODUCTS

2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may

submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.02 STANDARD PRODUCTS

A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.03 MANUFACTURER'S INSTRUCTIONS

A. The Contractor is responsible for furnishing the proper telecommunications equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Engineer in writing of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain from the Engineer instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Engineer.

2.04 RUST PREVENTION

A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.05 STORAGE AT SITE

A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

2.06 CONDITION OF MATERIALS

A. All materials required for the installation of the telecommunications systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being erected and installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.07 NAMEPLATES

A. Factory assembled components and equipment shall be provided with embossed nameplates, securely attached to the equipment with rivets or screws. Nameplates will have information required to specifically identify the equipment in the future such as the manufacturer's name, address, catalog number, serial number, etc. All data on nameplates shall be legible at the time of final inspection.

PART 3 – EXECUTION

3.01 ACCEPTABLE MANUFACTURERS

A. The specifications contain the names of manufacturers which are considered acceptable based on the quality of the product.

B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.

C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

D. The drawings represent the manufacturer's equipment scheduled. The listing of acceptable manufacturers in the specifications is not intended to imply that equipment of these other manufacturers will fit in the space provided or have the same electrical, structural or other requirements as the equipment scheduled. The Contractor must ensure that the equipment provided will meet all project requirements prior to submitting data on that equipment.

3.02 SPACE AND EQUIPMENT ARRANGEMENT

A. Equipment and components shall be installed in a manner to permit access to parts requiring service. Telecommunications equipment shall be installed in such a manner as to allow removal for service without disassembly of adjacent equipment.

B. Large equipment or apparatus which is to be installed in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly protected from damage.

C. Equipment shall have working clearances as required by applicable codes and standards.

3.03 SUBMITTAL AND REVIEW OF MATERIALS

A. After the Contract is awarded, but prior to proceeding with the Work, the Contractor shall obtain, check, certify, and submit complete Shop Drawings and Brochures from Manufacturers, Suppliers, Vendors, etc., for all materials and equipment specified herein. Submit Shop Drawings and Brochures in sufficient time so as not to impede the progress of work. Three weeks will be required for the processing of Shop Drawings and Brochures in the Engineer's office, exclusive of transmittal time. This time shall be considered by the Contractor when scheduling submittal data. After the Contract is awarded, the Contractor will advise the Engineer in writing of the schedule for submission of shop drawings and product data and the persons authorized to sign submittal data on behalf of the Company.

B. The Engineer's review of Shop Drawings and Brochures shall not relieve the Contractor of the responsibility for dimensions, errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the Engineer's noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the submittal data review.

C. Before submission of Shop Drawings and Brochures, the Contractor shall certify that each Shop Drawing and each item of material or equipment complies with the Contract Documents for this Project. Such certification shall be made by the Owner, a Partner, a Corporate Officer of the Contractor, or by a person duly authorized to sign for the Contractor. Unless so certified, Shop Drawings and/or Brochures will be returned for resubmittal. Certifications shall be in the form of rubber stamp impressions or typed letter which states:

I hereby certify that this Shop Drawing and/or brochure and the equipment and material shown on this Shop Drawing and/or Brochure complies in all aspects (except as noted*) with the requirements of the Contract Documents for this Project. I further certify that all data shown herein as to performance, dimensions, construction, materials, and other pertinent items are true and correct.

Name of Contractor_____

Signed_____

Position_____

Date_____

*Refer to exception requirements herein.

D. Each Shop Drawing shall indicate in the lower right hand corner and each Brochure shall indicate on the front cover the following: Title of the Sheet or Brochure; name and location of the building; names of the Engineer, Contractor, Manufacturer, Supplier, Vendor, etc., the date of submittal; and the date of each correction and revision. So far as is practical, each Shop Drawing and/or Brochure shall bear a cross-reference note to the sheet number or numbers of the Contract Drawings and Specifications showing the same work. Shop Drawings and Brochures shall be prepared as follows:

1. Shop Drawings: Drawings shall be newly prepared and not reproduced from the Contract Documents, drawn to a scale that can be easily read and shall contain sufficient plans, elevations, sections, and isometrics to describe clearly the items in question. Drawings shall be prepared by a draftsman skilled in this type of work. All equipment layouts and similar Shop Drawings shall be drawn to at least 1/4-inch = 1'-0" scale.

2. All Shop Drawings shall indicate the equipment actually purchased. The elevation, location, support points, load imposed on the structure at support and anchor points, shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. All Design Drawing space allocations shall be maintained, such as ceiling height, chase walls, equipment room size, etc., unless proper written authorization is required from the Engineer to change them. All associated equipment shall be coordinated and clearly shown on the Shop Drawings.

3. Brochures: Brochures submitted to the Engineer shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information to show that the equipment will fit into the allotted space.

4. Brochures submitted shall contain only information which is relevant to the particular equipment or materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless all irrelevant information is marked out or relevant information is clearly marked.

E. The submittal format shall follow the Specifications format with a submittal required for each required section. The submittal shall be contained in a three-ring hard back binder. Copies of each submittal shall be three-hole punched and arranged (or folded if required) for the Engineer's filing convenience. Provide one copy of updated TABLE OF CONTENTS and progressive-tabbed index sheets also for the Engineer's filing convenience.

F. Submittal data for each section must be complete. Partial submittals will not be reviewed. To the greatest extent possible all sections shall be submitted with the first submission. No more than three additional submissions will be allowed to complete the submittal package.

G. Unless a greater number is indicated within Division One of these specifications, submit six (6) copies of all Brochures for review. Submit one (1) reproducible and one (1) blueprint of shop drawings for review. Comments will be made on the reproducible to facilitate copying.

H. Any submittal that is disapproved must be resubmitted within two (2) weeks following notification of such disapproval. If no satisfactory material is submitted within the two-week period, the Engineer reserves the right to require the Contractor to furnish items exactly as described in the Contract Documents.

I. No allowances will be made for submittals which are not made in a timely fashion or which are turned down because they do not meet the specifications. Should delivery problems arise due to the above, affecting the completion time of the project, the Contractor will furnish and install acceptable alternates until the proper materials arrive and then replace the alternate materials with the approved materials, all at no cost to the Owner. If the Contractor is not able to furnish an acceptable alternate until the proper materials arrive, he will assume all costs for furnishing and installing all alternates as directed by the Engineer and/or will pay a suitable penalty for the inconvenience experienced by the Owner. This penalty will be set by the Owner based on the particular circumstances.

3.04 SUPERVISION

A. A competent certified foreman or superintendent, approved by the Engineer, shall be maintained at the project site to receive instructions and to act for the Contractor. Once this superintendent has been approved, no change shall be made without approval of the Owner or his authorized representative. The Owner and his authorized representative shall have the right to observe the work at any time. The Contractor shall have a representative present when his work is being observed, and he shall give assistance as required.

3.05 CUTTING AND PATCHING

A. Where it is necessary to cut through walls, floors, or ceilings to permit installation of work under this section of the Contract, or to repair any defects that may appear, up to the expiration of guarantee period, such cutting shall be done under the supervision of the Engineer. The Contractor shall not be permitted to cut or modify any structural members without the written permission of the Engineer.

B. Patching of all openings and repairing of any damage to the work of other trades occasioned by cutting operations, or occasioned by the failure of any part of work installed under this Contract, shall be performed by the trade whose work is involved, and shall be paid for by the Contractor.

C. Openings cut through exterior walls or roofs shall be provided with suitable covers to protect the property or materials involved. Openings cut through walls below grade shall be properly

protected to prevent entrance of water or other foreign elements. Openings cut between fire zones or plenums shall be sealed to maintain the fire integrity of the wall or floor. Conduits and cable tray through plenum wall shall be sealed using materials complying with UL 1479, NEC 300-21, and NEC 800-3(C), and shall be UL classified.

3.06 HOISTING, SCAFFOLDING, AND TRANSPORTATION

A. Provide hoisting and scaffolding facilities as required to set materials and equipment in place.

3.07 CLEANING

A. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish. Debris shall be removed from the site and from any street or alley adjacent to the site.

B. At completion of the project, the Contractor shall remove all tools, scaffolding, and surplus materials. Contractor shall leave the area "broom clean". Before final acceptance, vacuum all panels, cabinets, racks and other equipment enclosures. Wipe clean all fixture lenses and reflectors, all panelboard and switchboard interior and exterior surfaces, being careful to remove all stray paint, construction materials, dust, and particles. Touch-up all marred surfaces to restore existing conditions to those provided by the manufacturer.

3.08 CONDUIT SLEEVES

A. Where conduits pass through walls or floors not on fill, galvanized sheet metal sleeves shall be provided and shall be sealed to prevent air and noise transmission. In walls, they shall be flush with each finished surface. In pipe chases, they shall extend 1-1/2 inches above floor slab and be cemented in a water tight manner. Size of these sleeves shall be at least 1/2 inch greater than outside diameter of the conduit.

B. For conduits passing through outside walls, provide and install galvanized steel sleeves having an inside diameter at least 4 inches greater than the outside diameter of contained conduit. Where these occur in walls having a waterproof coating applied, the sleeves shall have welded flanges to build into waterproofing. When conduits are installed, the annular space between pipe and sleeve shall be effectively sealed, using shredded lead hammered in place or an approved mastic sealer.

C. Pipe and duct sleeves, pitch pockets, and flashings compatible with the roofing installation shall be provided for roof penetrations.

3.09 GROUNDING

A. Ground buses shall be provided in each Telecommunications room by Division 16 Contractor unless noted on Contract Drawings.

B. Telecommunications grounding system shall be a single point grounding from the building entrance electrical ground to each Telecommunications room. This Grounding system shall be provided by Division 16 Contractor unless notes on Contract Drawings.

C. All Conduit systems, cabinets' racks, cable trays, protector blocks, SCTP patch panels and/or miscellaneous equipment, etc. shall be grounded by being connected to the common telecommunications grounding system. The conductors shall be a # 6awg solid with a green jacket

3.10 RECEDENCE OF WORK

1. This Contract includes many different systems furnished and installed by different trades. All trades shall coordinate their work with that of all other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping other trades.

3.11 RECORD DRAWINGS

A. The Contractor shall keep a set of Drawings on the job, noting daily all changes made in these Drawings in connection with the final installation, including exact dimensioned locations of all new and uncovered existing active and inactive utilities outside the building, and shall turn over a clean, neatly marked set of mylar reproducible Drawings showing "as-installed" work to the Engineer for delivery to the Owner. All underground utilities, services, and systems shall be accurately located by the Contractor and dimensioned on the "as-installed" Drawings.

3.12 OPERATING AND MAINTENANCE MANUAL

A. The Contractor shall furnish indexed operating and maintenance manuals with complete technical data for each system, piece of equipment, and material installed under this Contract.

B. Two (2) copies of the manual, bound in hardback binders or an approved equivalent, shall be provided. One copy shall be completed and delivered to the Engineer prior to the time that system and equipment tests are performed. The second copy shall be delivered prior to final acceptance.
   1. Provide one (1) operation and Maintenance manual for each building. Provide one (1) as-built floor plan and one CD for each building.

C. The manual shall include the following information
   1. Manufacturer's installation instructions.
   2. Manufacturer's local representative and/or distributor's name and address.
   3. Manufacturer's operating and maintenance instructions.
   4. Manufacturer's internal wiring diagrams.
   5. Contractor's installation wiring diagrams.
   6. Replacement part number listings and descriptions.
   7. Framed operating instructions, when required, in individual Specification sections.
   8. Warranties and guarantees.
   9. Provide an approved submittal at the front of each section.

D. The manuals shall be identified on the cover as "Operating and Maintenance Manual" with additional cover display of the name and location of project, the Owner, the Engineers, the General Contractor, and the Subcontractors installing equipment represented in the brochure.

E. The manual shall have a Table of Contents and shall be grouped in sections according to the sections of Division 27. Each section shall have a copy of the pages of the Specifications covered within the section. Sections shall be organized as follows:
   1. Each section in the manual shall identify the grouping of all literature required for the system or equipment included.
   2. The contents of each section shall be arranged in the following sequence: First, the approved engineering submittals with complete performance and technical data; second, the manufacturer's installation brochure; third, the manufacturer's operating and maintenance brochure; fourth, the manufacturer's installation wiring diagram;

fifth, the Contractor's field wiring diagram, if different; and sixth, the manufacturer's brochure listing replacement part numbers and description.

3. Provide a final section entitled, "Warranties and Guarantees", for all equipment, etc.

3.13 EXISTING FACILITIES

1. The Contractor shall be responsible for loss or damage to the existing facilities and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices and receive written permission from the Owner to enter existing areas. Before beginning work in existing areas, the Contractor shall make necessary arrangements and perform other services required for the care, protection, and in-service maintenance of all electrical, communication, plumbing, heating, air condition, and ventilating services for new and existing facilities. The Contractor shall erect temporary barricades with necessary safety devices to protect personnel from injury, removing all such temporary protection upon completion of the work.

2. The Contractor shall provide temporary or new services to existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

3. Where existing construction is removed to provide working and extension access to existing utilities, the Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air condition ductwork, and equipment, etc. to provide this access and shall reinstall same upon completion of work.

4. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, the Contractor shall remove and reinstall in locations approved by the Engineer all devices required for the operation of the electrical systems installed in the existing construction. This is to include, but is not limited to, temperature control system devices, electrical switches, relays, fixtures, piping, conduit, etc.

3.14 DEMOLITION AND RELOCATION

1. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.

2. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Engineer. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Engineer and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at not additional cost to the Owner or the Engineer.

3. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be performed by workmen skilled in the work ad in accordance with standard practice of the trades involved.

4. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to

points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Engineer.

3.15 OUTAGES

1. Outages of services as required by the project will be permitted, but only at a time approved by the Owner. The Contractor shall notify the Owner in writing two (2) weeks in advance of the requested outage in order to schedule required outages. No outages shall be taken unless written approval has first been received from the Owner. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the Contract amount.

END OF SECTION

SECTION 27 10 00 - STRUCTURED CABLING SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Summary of Work:
1. Provide a complete and tested cable distribution system for data interconnections (Local Area Network). The data distribution system shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, UTP termination devices, data communications outlets, fiber enclosures, patch panels, patch cables, network racks, and other incidental and miscellaneous premises wiring system hardware as required for a complete and usable system. The installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications.

1.2 QUALITY ASSURANCE

A. Acceptable manufacturers:
1. The equipment/products described herein, and furnished per these specifications shall be the product of one manufacturer. All references to model numbers and other detailed descriptive data are intended to establish standards of design performance, and quality, as required.
2. Acceptable product manufacturers shall provide a complete category 6 solution as manufactured by **Panduit only**. No other manufacturers will be allowed.
3. Provide CAT6A cabling, connectors, patch cables, etc. for all video surveillance cameras and wireless access points. One CAT6A cable per device.

B. Installer Qualifications:
1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Category 6 premises wiring system installations.
2. All Data Cable Systems installation shall be performed by a (BICSI) Certified - Registered Telecommunications Technician or under the direct supervision of a (BICSI) Certified - Registered Communications Distribution Designer (RCDD).
3. All Data Cable Systems installation shall be performed by a factory/manufacturer certified installer.
4. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing SCS contractor will be allowed for any portion of the SCS scope of work.

C. Pre-Construction Meeting:
1. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner’s representative prior to the start of the work.

D. Acceptance:
1. The Owner’s representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Warranty:

1. The selected system installer shall be a certified installing contractor of product and hold current certification. Contractor shall be shall provide an end-to-end performance warranty of no less than 20 years. The warranty shall be the maximum provided by the manufacturer. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL Category 6 cable links have been tested bi-directionally (end to end) using a Level 2 tester, per TSB-67, and that all test results conform to the most current TIA/EIA-568-A and/or TSB-67 Link values.
2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.
3. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ISO/IEC 11801, ANSI/TIA/EIA-568-A, or EN 50173. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

1.3 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
2. 2015 National Electrical Code

B. Other References:
1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
8. ISO/IEC 11801 Generic Cabling Standard
9. EN 50173 Generic Cabling Standards for Customer Premises
10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts:
1. If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.4 ABBREVIATIONS

A. The following abbreviations are used in this document:

DC	Direct Current
IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
PBX	Private Branch Exchange

UTP Unshielded Twisted Pair

1.5 SUBMITTALS

A. Project Initiation:
1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
   a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
   b. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
   c. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
   d. Testing: Proposed Contractor Category 6 UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.

B. Shop Drawings:
1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
   a. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current.
   b. Conformance: For items which are being provided exactly as specified, provide a letter stating the item description and model number, and that it is being provided as specified. For items which are not as specified, provide standard manufacturer's cut sheets or other descriptive information and a written description detailing the reason for the substitution.
   c. Provide RCDD certification

C. Project Completion:
1. As a condition for project acceptance, the Contractor shall submit the following for review and approval:
   a. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
   b. Inspection and Test Reports: During the course of the project, the Contractor shall maintain an adequate inspection system to insure that the materials supplied and the work performed conform to Contract requirements. The contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
   c. Operating and Maintenance Instructions: Operating and maintenance instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner for their use in a three-ring binder labeled with the project name and description (4 copies).
   d. As-Built Drawings: As-built drawings will include cable pathways, data outlet locations with correct labeling and MDF location. The as-built

drawings will be prepared using AutoCAD version 13 or later. Provide the Owner with one mylar plot of each drawing and two blue line prints of each drawing. Provide the Owner with electronic versions of the as-builts on 2 qty. 8MB thumb drives.

PART 2 - PRODUCTS

2.1 GENERAL

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect/Engineer to review.

C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.

D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
1. Approved Products
a. Twisted-pair cable: Dyna-Blue
American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
1. Approved Products
a. 3M or
b. Pre-approved equal

2.2 DATA CLOSET (MDF/IDF) CATEGORY 6 TERMINATION HARDWARE

A. Equipment Racks/Cabinets:
1. All locations that require Two post rack shall use – Chatsworth #55053-703
2. For all locations that require Two-post racks The contractor shall Provide and install (2) Chatsworth Double sided Cable managers. (1) for each side Chatsworth #35521-703
3. All locations that require a wall mounted Cabinet shall use – Chatsworth 12419-748, 30 in. deep rack, with the exception of the Athletic Field Press Boxes.

4. All three Athletic Field Press Boxes shall be equipped with a Mier BW-RACK-8-ACE, 12RU 800 BTU Air-Conditioned wall mount rack.
   a. Install rack on wall at 80” A.F.F. TO THE BOTTOM OF THE RACK.
5. Provide plywood backing to support cabinet and paint to match wall color.

B. Distribution Rack Grounding

All Racks shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.

1. Approved Products – Ground Terminal Block
   Chatsworth Products, Inc. (CPI) #08009-001
2. Approved Products – Wall Mount Bus Bar (one pre MDF/IDF location)
   Chatsworth Products, Inc. (CPI) #10622-010

C. Fiber Optic Patch Panels

Provide (4) duplex fiber patch cords for each run installed. Verify Connection types with the owner prior to purchase

1. Approved Products:
   a. Patch Panels
      1. Panduit model #FRME1 for 1RU enclosures
      2. Panduit model #FRME2 for 2RU enclosures

The enclosures used shall provide termination panels for LC type connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19” rack mountable. Provide all termination accessories, fiber patch cords, enclosures and test for a complete fiber optic distribution system.

D. Modular Patch Panels: The Category 6 data station cable shall be terminated on a modular patch panels with rear mounted faceplates. Patch panels shall be 19-inch rack mountable. Workstation patch panels shall terminate all workstation communications outlets. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.

1. Approved Products:
2.
   b. Patch Panels
      1. Panduit 24 Port #CPP24FMWBLY Mini-Com Flush Mount Modular Patch Panels
      2. Panduit 48 Port #CPP48FMWBLY Mini-Com Flush Mount Modular Patch Panels
   c. Provide cable support bars at the back of all patch panels to provide additional support at rear of rack and panels.
   d. Provide category 6 Jack Modules to terminate 110% of the total cable to each communications closet.

E. Power Strip: A power strip shall be installed horizontally at the back of each data rack.

1. Approved Products
   a. Chatsworth Products, Inc. (CPI) #12816-702

F. Cable Management Panels: Provide cable management panels as required for horizontal and vertical cable management. Provide vertical wire management on ends and in between all racks on entire project.

1. Approved Products

a. Horizontal – Panduit NCMHF1 (1-1/2”) NCMHF2 (3”)
b. Vertical – Panduit PRV8 with PRD8 double hinge doors

G. Network Rack Patch Cables: Cabling Contractor shall provide owner with one (1) Category 6 patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment provided by owner upon move-in. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.
1. Approved Products:
All patch cords shall be manufactured by Panduit.

Headend patch cable colors shall be:
DATA / NETWORK – WHITE
INTERCOM / FRONTROW – BLUE
SECURITY / IP CAMERAS – GREEN
ACCESS POINTS / WAPs – RED
HVAC / BAS – PINK

a. Contractor to provide patch cables for each system as indicated above
1) Provide 1’ patch cables for MDF / IDF racks 100%

F. Category 3 cabling:
1. General Cable #2131505, 25 pair CAT3 cable.

2.3 CABLE ROUTING/PATHWAY

A. Cable Support System: Cable saddles, bridal rings or J-Hooks shall be used to route all exposed cables (cable not in conduit or cable tray) in open access environments as well as in communications closets.
1. Approved Products
a. Chatsworth Products Inc. (CPI) or
b. ComDangles

2.4 STATION WIRING

A. Wire: The data and voice wire provided for all outlets shall be (Category 6) unshielded twisted pair, four-pair, 24 AWG solid copper conductor, meeting the intent and quality level of the TIA/EIA-568-A Commercial Building Wiring Standard. Refer to floor plan and data outlet legend for number of active data ports to specified faceplates.
1. Approved Products: For all voice and data connections:

All wiring on the project shall be plenum-rated, Category 6, blue in color
Approved Manufacturers
1. Panduit TX6000, Model #PUP6004BU-UY

B. Testing: The Category 6 four-pair UTP cable must be UL Performance Level tested. Each 1000 foot spool must be individually tested with test results affixed to the spool.
1. For video surveillance cameras and wireless access points, provide Category 6A, blue in color: Panduit, Model #PUP6XHD04BU-G

C. Rating: Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non plenum rated otherwise.

2.5 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be high quality Category 6 RJ45 modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for Category 6 connecting hardware.

1. Approved Products:
   a. Data Inserts
      1. Panduit TX6 Category 6 Jack Module, #CJ688TGxx.
      2. See 2.2. G. 1. above to match module color to patch cable color for each application.
   b. Wireless Access Point Inserts
      1. Provide Tile Bridge with box to install AP outlet flush with ceiling.
      2. Provide a biscuit with terminated cable for each Access Point, installed above ceiling.
   c. IP Camera Inserts
      1. Panduit Category 6A Jack Module, Green in color. #CJ6X88TGGR
      2. Provide (1) CAT6A cable for each IP Camera.
   d. Wireless Access Point Inserts
      3. Panduit Category 6A Jack Module, Red in color. #CJ6X88TGRD
      4. Provide Tile Bridge with box to install AP outlet flush with ceiling.
      5. Provide (1) CAT6A cable for each Access Point.

2. All blank inserts shall be gray in color

B. Faceplates: Faceplates shall be a 4-port, flush mounted, 110 style, stainless steel in color for RJ45 outlets at all locations.

1. Approved Products:
   a. 4-Port Single Gang,
      1. Panduit Product Code #CFP4S

   b. Provide wall mounted handset faceplates where applicable for wall mounted phone. Refer to floor plan for locations.
   c. Mounting Straps (where applicable)

C. Workstation Patch Cables: Cabling Contractor shall provide owner with one (1) Category 6 patch cable for each data drop on entire project. Each cable will be factory terminated with RJ45 connections on each end with appropriate pin-out assignments per project configuration.

1. Approved Products:
   All Patch Cords to be manufactured by Panduit.

   a. Cat 6 Patch Cable BLUE in color
      1) All patch cables shall match the installed structured cabling system.
   b. Contractor to provide patch cables for each system as indicated:
      2) 100% - 10’

2.6 FIBER OPTIC PRODUCTS

1. Approved Products:
   a. 12 strand, single-mode indoor/outdoor, plenum rated with armored jacket,. Terminate with Panduit pre-polished LC style connectors.
   Approved Part Numbers
      1. Panduit #FSGP912Y

b. 24 strand, single-mode, indoor/outdoor stranded tube cable, riser (OFNR), 250um Fibers. Terminate with Panduit pre-polished LC style connectors
Approved Part Numbers
1. Panduit #FSNR924Y

PART 3 - EXECUTION

3.1 GENERAL

A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Allowable Cable Bend Radius And Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.

C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.

E. Conduit Fill: Conduit fill shall not exceed 40%.

F. Damage:
1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

G. Clean Up:
All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

A. Labels
Coordinate all labeling schemes at headend and on cable with owner prior to permanently installing and testing outlets.

The Contractor will label all outlets using permanent/legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least on-eighth inch (1/8”) in height, block. All labels shall correspond to as-builts and to final test reports.

The following nomenclature should be used when labeling all ports:

All cables being served by MDF closet shall begin with ‘MC’ all IDF served cables shall begin

with 'IC#' (# designated IDF closet number).

Next identification shall note what # data port on patch panel (1 thru 48).

Example:

Outlet from 23rd port of the third patch panel from top of rack located at IDF-2
IC2-P3-23

Outlet from the 5th port of the second patch panel from the top of rack located at MDF
MC-B2-05

B. Floor Plan: A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

C. Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.

D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.

E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #.

F. Spreadsheet:
A laminated, detailed spreadsheet indicating port # and which room outlet it serves shall be mounted to the rack in each communications closet.

3.3 EQUIPMENT RACK CONFIGURATION

A. Equipment Racks: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each rack shall be securely mounted to the floor and braced to the wall with cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with NEC requirements.

B. Wire Management Components: Horizontal cable management panels shall be installed directly above and below each patch panel, also 2 per each 48 port patch panel should be left at site to accommodate the switch gear when they are installed. Vertical cable management panels shall be installed on each side of the rack. In instances where more than one rack is installed in a single location, vertical cable management shall be installed between the racks and on either side.

C. Cable Placement: Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

E. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

F. Hardware: Provide rack and jack panel hardware as required for all data station wiring.

3.4 STATION WIRING INSTALLATION

A. General:
1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed Category 6 UTP cable at either the wiring closet or the workstation termination locations.

B. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings.
2. Additional exposed cable runs will require Owner approval, and will only be allowed when no other options exist.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:
1. All cabling placed in ceiling areas must be in conduit, cable tray or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section.
2. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Chatsworth hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable rings on 36-inch maximum centers to hang cable. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be bundled together every 6 feet.

3.5 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be mounted in a faceplate with backbox.

B. Placement: Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.

C. RJ-45 Jack Pin Assignments:
1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
2. Pin connections at data jack panels shall match pin connections at outlets (straight

through wiring).

3.6 CABLE TESTING REQUIREMENTS

A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.

E. Twisted Pair Cable Testing:
   1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Category 6 products shall be tested for compliance to ANSI/TIA/EIA 568A and ISO/IES 11801 for a Category 6 rated installation. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.
   2. Each wire/pair shall be tested at both ends for the following:
      a. Wire map (pin to pin connectivity)
      b. Length (in feet)
      c. Attenuation
      d. Near end cross talk (NEXT)
      e. Power Sum
   3. Test equipment shall provide an electronic and printed record of these tests.
   4. Test results for each Category 6 four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.

F. Testing: Once installed the cabling will be tested for continuity, shorts and grounds.
   1. Cabling:
      a. Continuity – 100% continuity testing is required and will be tested from the MDF/IDF location to each classroom drop. A checklist of each cable and test performed on that cable will be submitted once the testing has been completed.
      b. Shorts – No cable shorts will be permitted on the system. If a short is detected, the connector or cable will be repaired or replaced.
      c. Grounds – No direct ground on the center conductor of the AVDN cables are permitted.
   2. System:
      a. Continuity – As tested in the above testing requirements.
      b. Power Readings – A power reading will be required at each drop of each of the cabling systems. A +3 dB to a +7 dB is required at each drop with a common feed signal of + 15 dB into the head end amplifier. These measurements to be taken with an approved field strength meter of know

calibration. Test measurements to be performed at low channel, mid-band channel, and high channel to determine cable slope.

c. Signal Quality – A standard receiver, typical of those used in the system, shall randomly be connected to 10% of the outlets across the system and tuned to a reference channel of known quality. No visible indication of co-channel interference, noise, ghosting, or beat interference may be observed.

d. Carrier to Noise – Carrier to Noise shall be measured at random outlets representing an average cross section of the drops with an approved field strength meter by the following process. With normal operating levels the field set shall be tuned to each channels visual carrier and the level recorded. The input signal to the head end amplifier shall be removed and the input of the amplifier terminated with a short. Each channel shall be re-measured and the noise levels recorded. The Carrier to Noise measurement is the difference of the two figures.

e. Documentation of Results – All recorded measurements are to be tabulated and included in the systems documentation manual for reference during maintenance of the system.

3.7 INSPECTION

A. General: Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.

END OF SECTION

SECTION 27 10 00 - STRUCTURED CABLING SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Summary of Work:
1. Provide a complete and tested cable distribution system for data interconnections (Local Area Network). The data distribution system shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, UTP termination devices, data communications outlets, fiber enclosures, patch panels, patch cables, network racks, and other incidental and miscellaneous premises wiring system hardware as required for a complete and usable system. The installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications.

1.2 QUALITY ASSURANCE

A. Acceptable manufacturers:
1. The equipment/products described herein, and furnished per these specifications shall be the product of one manufacturer. All references to model numbers and other detailed descriptive data are intended to establish standards of design performance, and quality, as required.
2. Acceptable product manufacturers shall provide a complete category 6 solution as manufactured by **Panduit only**. No other manufacturers will be allowed.
3. Provide CAT6A cabling, connectors, patch cables, etc. for all video surveillance cameras and wireless access points. One CAT6A cable per device.

B. Installer Qualifications:
1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Category 6 premises wiring system installations.
2. All Data Cable Systems installation shall be performed by a (BICSI) Certified - Registered Telecommunications Technician or under the direct supervision of a (BICSI) Certified - Registered Communications Distribution Designer (RCDD).
3. All Data Cable Systems installation shall be performed by a factory/manufacturer certified installer.
4. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing SCS contractor will be allowed for any portion of the SCS scope of work.

C. Pre-Construction Meeting:
1. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner’s representative prior to the start of the work.

D. Acceptance:
1. The Owner’s representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Warranty:

1. The selected system installer shall be a certified installing contractor of product and hold current certification. Contractor shall be shall provide an end-to-end performance warranty of no less than 20 years. The warranty shall be the maximum provided by the manufacturer. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL Category 6 cable links have been tested bi-directionally (end to end) using a Level 2 tester, per TSB-67, and that all test results conform to the most current TIA/EIA-568-A and/or TSB-67 Link values.
2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.
3. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ISO/IEC 11801, ANSI/TIA/EIA-568-A, or EN 50173. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

1.3 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
2. 2015 National Electrical Code

B. Other References:
1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
8. ISO/IEC 11801 Generic Cabling Standard
9. EN 50173 Generic Cabling Standards for Customer Premises
10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts:
1. If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.4 ABBREVIATIONS

A. The following abbreviations are used in this document:

DC	Direct Current
IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
PBX	Private Branch Exchange

UTP Unshielded Twisted Pair

1.5 SUBMITTALS

A. Project Initiation:
1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
   a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
   b. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
   c. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
   d. Testing: Proposed Contractor Category 6 UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.

B. Shop Drawings:
1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
   a. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current.
   b. Conformance: For items which are being provided exactly as specified, provide a letter stating the item description and model number, and that it is being provided as specified. For items which are not as specified, provide standard manufacturer's cut sheets or other descriptive information and a written description detailing the reason for the substitution.
   c. Provide RCDD certification

C. Project Completion:
1. As a condition for project acceptance, the Contractor shall submit the following for review and approval:
   a. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
   b. Inspection and Test Reports: During the course of the project, the Contractor shall maintain an adequate inspection system to insure that the materials supplied and the work performed conform to Contract requirements. The contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
   c. Operating and Maintenance Instructions: Operating and maintenance instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner for their use in a three-ring binder labeled with the project name and description (4 copies).
   d. As-Built Drawings: As-built drawings will include cable pathways, data outlet locations with correct labeling and MDF location. The as-built

drawings will be prepared using AutoCAD version 13 or later. Provide the Owner with one mylar plot of each drawing and two blue line prints of each drawing. Provide the Owner with electronic versions of the as-builts on 2 qty. 8MB thumb drives.

PART 2 - PRODUCTS

2.1 GENERAL

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect/Engineer to review.

C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.

D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
1. Approved Products
a. Twisted-pair cable: Dyna-Blue
American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
1. Approved Products
a. 3M or
b. Pre-approved equal

2.2 DATA CLOSET (MDF/IDF) CATEGORY 6 TERMINATION HARDWARE

A. Equipment Racks/Cabinets:
1. All locations that require Two post rack shall use – Chatsworth #55053-703
2. For all locations that require Two-post racks The contractor shall Provide and install (2) Chatsworth Double sided Cable managers. (1) for each side Chatsworth #35521-703
3. All locations that require a wall mounted Cabinet shall use – Chatsworth 12419-748, 30 in. deep rack, with the exception of the Athletic Field Press Boxes.

4. All three Athletic Field Press Boxes shall be equipped with a Mier BW-RACK-8-ACE, 12RU 800 BTU Air-Conditioned wall mount rack.
   a. Install rack on wall at 80” A.F.F. TO THE BOTTOM OF THE RACK.
5. Provide plywood backing to support cabinet and paint to match wall color.

B. Distribution Rack Grounding

All Racks shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.

1. Approved Products – Ground Terminal Block
   Chatsworth Products, Inc. (CPI) #08009-001
2. Approved Products – Wall Mount Bus Bar (one pre MDF/IDF location)
   Chatsworth Products, Inc. (CPI) #10622-010

C. Fiber Optic Patch Panels

Provide (4) duplex fiber patch cords for each run installed. Verify Connection types with the owner prior to purchase

1. Approved Products:
   a. Patch Panels
      1. Panduit model #FRME1 for 1RU enclosures
      2. Panduit model #FRME2 for 2RU enclosures

The enclosures used shall provide termination panels for LC type connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19” rack mountable. Provide all termination accessories, fiber patch cords, enclosures and test for a complete fiber optic distribution system.

D. Modular Patch Panels: The Category 6 data station cable shall be terminated on a modular patch panels with rear mounted faceplates. Patch panels shall be 19-inch rack mountable. Workstation patch panels shall terminate all workstation communications outlets. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.

1. Approved Products:
2.
   b. Patch Panels
      1. Panduit 24 Port #CPP24FMWBLY Mini-Com Flush Mount Modular Patch Panels
      2. Panduit 48 Port #CPP48FMWBLY Mini-Com Flush Mount Modular Patch Panels
   c. Provide cable support bars at the back of all patch panels to provide additional support at rear of rack and panels.
   d. Provide category 6 Jack Modules to terminate 110% of the total cable to each communications closet.

E. Power Strip: A power strip shall be installed horizontally at the back of each data rack.

1. Approved Products
   a. Chatsworth Products, Inc. (CPI) #12816-702

F. Cable Management Panels: Provide cable management panels as required for horizontal and vertical cable management. Provide vertical wire management on ends and in between all racks on entire project.

1. Approved Products

a. Horizontal – Panduit NCMHF1 (1-1/2") NCMHF2 (3")
b. Vertical – Panduit PRV8 with PRD8 double hinge doors

G. Network Rack Patch Cables: Cabling Contractor shall provide owner with one (1) Category 6 patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment provided by owner upon move-in. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.
1. Approved Products:
All patch cords shall be manufactured by Panduit.

Headend patch cable colors shall be:
DATA / NETWORK – WHITE
INTERCOM / FRONTROW – BLUE
SECURITY / IP CAMERAS – GREEN
ACCESS POINTS / WAPs – RED
HVAC / BAS – PINK

a. Contractor to provide patch cables for each system as indicated above
1) Provide 1' patch cables for MDF / IDF racks 100%

H. Category 3 cabling:
1. General Cable #2131505, 25 pair CAT3 cable.

I. Site Plan Camera Equipment: IP Camera Contractor shall provide CommScope PFP-PX-S2 power supply. Equip power supply with two PFP-PX-8M distribution models, one PFP-PX-A1 Alarm Card, one PFP-SPS-C1 Controller and one PFP-SPS-1600M, installed in MDF A113.
1. Fiber patch panel – Model # - EPX-1U-PNL-ENC, installed in MDF
2. Fiber cassette qty of 3 - Model # 760221747
3. Surge protector qty of 7 – Model # DTK-2MHLP48B
4. Surge protector base qty of 2- Model # DTK-4MB
5. Hybrid Fiber/Copper cable – Model # PFC-SO2012
6. POE extender qty of 13- Model # PFU-P-C-O-060-01
a. Installed at each camera mounted at lighting pole.
b. Extender will need to be grounded
c. Terminate fiber in extender
7. Qty 13 Cat6 OSP F/UTP patch cord, 7ft – Model # C011152-01F007
8. SFP qty of 13- Model # TN-GLC-LX-SM-RGD at PoE Extenders, qty 13 at MDFA113

2.3 CABLE ROUTING/PATHWAY

A. Cable Support System: Cable saddles, bridal rings or J-Hooks shall be used to route all exposed cables (cable not in conduit or cable tray) in open access environments as well as in communications closets.
1. Approved Products
a. Chatsworth Products Inc. (CPI) or
b. ComDangles

2.4 STATION WIRING

A. Wire: The data and voice wire provided for all outlets shall be (Category 6) unshielded twisted pair, four-pair, 24 AWG solid copper conductor, meeting the intent and quality level of the TIA/EIA-568-A Commercial Building Wiring Standard. Refer to floor plan and data outlet legend for number of active data ports to specified faceplates.
1. Approved Products: For all voice and data connections:

All wiring on the project shall be plenum-rated, Category 6, blue in color
Approved Manufacturers
1. Panduit TX6000, Model #PUP6004BU-UY

B. Testing: The Category 6 four-pair UTP cable must be UL Performance Level tested. Each 1000 foot spool must be individually tested with test results affixed to the spool.
1. For video surveillance cameras and wireless access points, provide Category 6A, blue in color: Panduit, Model #PUP6XHD04BU-G

C. Rating: Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non plenum rated otherwise.

2.5 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be high quality Category 6 RJ45 modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for Category 6 connecting hardware.

1. Approved Products:
   a. Data Inserts
      1. Panduit TX6 Category 6 Jack Module, #CJ688TGxx.
      2. See 2.2. G. 1. above to match module color to patch cable color for each application.
   b. Wireless Access Point Inserts
      1. Provide Tile Bridge with box to install AP outlet flush with ceiling.
      2. Provide a biscuit with terminated cable for each Access Point, installed above ceiling.
   c. IP Camera Inserts
      1. Panduit Category 6A Jack Module, Green in color. #CJ6X88TGGR
      2. Provide (1) CAT6A cable for each IP Camera.
   d. Wireless Access Point Inserts
      3. Panduit Category 6A Jack Module, Red in color. #CJ6X88TGRD
      4. Provide Tile Bridge with box to install AP outlet flush with ceiling.
      5. Provide (1) CAT6A cable for each Access Point.

2. All blank inserts shall be gray in color

B. Faceplates: Faceplates shall be a 4-port, flush mounted, 110 style, stainless steel in color for RJ45 outlets at all locations.

1. Approved Products:
   a. 4-Port Single Gang,
      1. Panduit Product Code #CFP4S

   b. Provide wall mounted handset faceplates where applicable for wall mounted phone. Refer to floor plan for locations.
   c. Mounting Straps (where applicable)

C. Workstation Patch Cables: Cabling Contractor shall provide owner with one (1) Category 6 patch cable for each data drop on entire project. Each cable will be factory terminated with

RJ45 connections on each end with appropriate pin-out assignments per project configuration.

1. Approved Products:
All Patch Cords to be manufactured by Panduit.

a. Cat 6 Patch Cable BLUE in color
1) All patch cables shall match the installed structured cabling system.
b. Contractor to provide patch cables for each system as indicated:
2) 100% - 10’

2.6 FIBER OPTIC PRODUCTS

1. Approved Products:
a. 12 strand, single-mode indoor/outdoor, plenum rated with armored jacket,. Terminate with Panduit pre-polished LC style connectors.
Approved Part Numbers
1. Panduit #FSGP912Y

b. 24 strand, single-mode, indoor/outdoor stranded tube cable, riser (OFNR), 250um Fibers. Terminate with Panduit pre-polished LC style connectors
Approved Part Numbers
1. Panduit #FSNR924Y

PART 3 - EXECUTION

3.1 GENERAL

A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Allowable Cable Bend Radius And Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.

C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.

E. Conduit Fill: Conduit fill shall not exceed 40%.

F. Damage:
1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

G. Clean Up:
All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

A. Labels
Coordinate all labeling schemes at headend and on cable with owner prior to permanently installing and testing outlets.

The Contractor will label all outlets using permanent/legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least on-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

The following nomenclature should be used when labeling all ports:

All cables being served by MDF closet shall begin with 'MC' all IDF served cables shall begin with 'IC#' (# designated IDF closet number).

Next identification shall note what # data port on patch panel (1 thru 48).

Example:

Outlet from 23rd port of the third patch panel from top of rack located at IDF-2
IC2-P3-23

Outlet from the 5th port of the second patch panel from the top of rack located at MDF
MC-B2-05

B. Floor Plan: A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

C. Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.

D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.

E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #.

F. Spreadsheet:
A laminated, detailed spreadsheet indicating port # and which room outlet it serves shall be mounted to the rack in each communications closet.

3.3 EQUIPMENT RACK CONFIGURATION

A. Equipment Racks: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each rack shall be securely mounted to the floor and braced to the wall with cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with NEC requirements.

B. Wire Management Components: Horizontal cable management panels shall be installed directly above and below each patch panel, also 2 per each 48 port patch panel should be left at site to accommodate the switch gear when they are installed. Vertical cable management panels shall be installed on each side of the rack. In instances where more than one rack is installed in a single location, vertical cable management shall be installed between the racks and on either side.

C. Cable Placement: Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

E. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

F. Hardware: Provide rack and jack panel hardware as required for all data station wiring.

3.4 STATION WIRING INSTALLATION

A. General:
1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed Category 6 UTP cable at either the wiring closet or the workstation termination locations.

B. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings.
2. Additional exposed cable runs will require Owner approval, and will only be allowed when no other options exist.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner’s efficient use of their full capacity.

D. Cable Routes:
1. All cabling placed in ceiling areas must be in conduit, cable tray or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section.
2. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks

for up to 15 cables (Chatsworth hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable rings on 36-inch maximum centers to hang cable. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be bundled together every 6 feet.

3.5 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be mounted in a faceplate with backbox.

B. Placement: Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.

C. RJ-45 Jack Pin Assignments:
1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring).

3.6 CABLE TESTING REQUIREMENTS

A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor’s use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.

E. Twisted Pair Cable Testing:
1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Category 6 products shall be tested for compliance to ANSI/TIA/EIA 568A and ISO/IES 11801 for a Category 6 rated installation. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.
2. Each wire/pair shall be tested at both ends for the following:
   a. Wire map (pin to pin connectivity)
   b. Length (in feet)
   c. Attenuation
   d. Near end cross talk (NEXT)
   e. Power Sum
3. Test equipment shall provide an electronic and printed record of these tests.
4. Test results for each Category 6 four-pair UTP cable must be submitted with

identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.

F. Testing: Once installed the cabling will be tested for continuity, shorts and grounds.
   1. Cabling:
      a. Continuity – 100% continuity testing is required and will be tested from the MDF/IDF location to each classroom drop. A checklist of each cable and test performed on that cable will be submitted once the testing has been completed.
      b. Shorts – No cable shorts will be permitted on the system. If a short is detected, the connector or cable will be repaired or replaced.
      c. Grounds – No direct ground on the center conductor of the AVDN cables are permitted.
   2. System:
      a. Continuity – As tested in the above testing requirements.
      b. Power Readings – A power reading will be required at each drop of each of the cabling systems. A +3 dB to a +7 dB is required at each drop with a common feed signal of + 15 dB into the head end amplifier. These measurements to be taken with an approved field strength meter of know calibration. Test measurements to be performed at low channel, mid-band channel, and high channel to determine cable slope.
      c. Signal Quality – A standard receiver, typical of those used in the system, shall randomly be connected to 10% of the outlets across the system and tuned to a reference channel of known quality. No visible indication of co-channel interference, noise, ghosting, or beat interference may be observed.
      d. Carrier to Noise – Carrier to Noise shall be measured at random outlets representing an average cross section of the drops with an approved field strength meter by the following process. With normal operating levels the field set shall be tuned to each channels visual carrier and the level recorded. The input signal to the head end amplifier shall be removed and the input of the amplifier terminated with a short. Each channel shall be re-measured and the noise levels recorded. The Carrier to Noise measurement is the difference of the two figures.
      e. Documentation of Results – All recorded measurements are to be tabulated and included in the systems documentation manual for reference during maintenance of the system.

3.7 INSPECTION

A. General: Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.

END OF SECTION

SECTION 27 41 16 - INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

A. All Division 26 at it relates to this scope of work.
B. Section 27 00 00
C. Section 27 10 00
D. Section 27 31 00

1.2 DESCRIPTION

A. Summary of Work:
   1. Provide a complete and tested classroom presentation system. The presentation system shall include, but not be limited to the following:
      a. Contractor shall provide and install all audiovisual faceplates, transmission media infrastructure, and a patch cables required to connect each presentation device to the associate input device
      b. Proposing contractor must coordinate with project construction schedule and existing technology system contractor to provide complete turn-key solution to owner.
   2. The installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications.
   3. Reference project drawings for locations, quantities, and coordination with other trades.

1.3 QUALITY ASSURANCE

A. Contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein describe will be disqualified.

B. The Contractor, as a business entity, shall be an authorized distributor and designated representative of the equipment manufacturer, with full warranty privileges. The proposed contractor shall have been actively engaged in the business of selling, installing, and servicing commercial building commercial communication systems for a period of at least 5 years.

C. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.

D. The Contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.

E. The Contractor shall be fully experienced in the design and installation of the type of system herein specified, and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the

amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150- mile radius of the school district to allow school administration officials to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

F. The Contractor shall employ factory-trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this training shall be provided with the contractors' submittal.

G. The Contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response. A Proposed Contractor that has any prior finding(s) of a code violation or has any litigation in process concerning the installation of a communication system is unacceptable.

H. Any discrepancy in quantity or part numbers between the drawings and the bid specifications shall be brought to the attention of the Consultant for clarification during the bidding period. No allowance shall be made to the Contractor by reason of failure to have brought said discrepancies to the attention of the Consultant prior to award of contract.

I. The Contractor shall provide all necessary patch cables, riser/plenum cabling and connectors interconnecting all equipment and all required A/V and network equipment to provide for fully functional systems. In addition, all cabling raceway, support systems, sleeves and any other materials required to properly install and support cabling systems.

J. The ability of the Contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

K. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

L. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

M. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfill of any part of the contract or to complete the work contemplated therein.

N. The Owner reserves the right to reject the proposal of any Contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

O. Pre-Construction Meeting:

1. The successful Contractor shall attend mandatory pre-construction meetings with individuals deemed necessary by the Owner's representative prior to the start of the work.
2. The contractor shall provide a mock-up of the complete classroom projector system to include all products listed in Part 2 of this specification.
3. All proposing contractors must have ability to demonstrate a/v system being proposed and provide owner with completely installed system to evaluate performance and operation.

P. Acceptance:

1. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Latest Local Codes and Amendments
   2. 2015 National Electrical Code

B. Other References:
   1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
   2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
   3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
   4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
   5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
   6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
   7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
   8. ISO/IEC 1180 Generic Cabling Standard
   9. EN 50173 Generic Cabling Standards for Customer Premises
   10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts:
   1. If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.5 ABBREVIATIONS

A. The following abbreviations are used in this document:

FR	FrontRow Trio/Elevate ceiling mount enclosure
PS	Presentation Station
CP	FrontRow Trio/Elevate system control panel

1.6 SUBMITTALS

A. Project Initiation:
   1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
      a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
      b. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility

with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided

c. **Product Bill of Materials that includes make, model and quantity of all equipment and materials being provided by the contractor.**

d. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.

e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the Audio-Video installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.

f. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.

1) Installer Certification: This certification shall show successful completion of system training and must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:

a. Floor plans indicating proposed cable routing and cable grouping plan prepared by a qualified system designer. The credentials of the designer must be accepted the project's technology consultant prior to submitting a system design.

b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:

1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
2) Location of sleeved wall pass-thru
3) Size of sleeve at each location installed
4) Quantity of cable passing through each sleeve
5) **Location of all A/V devices including but not limited to displays, speakers, enclosures, input/output plates, and control panels in each room**
6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
7) **One-line schematics of each system and/or system type.**

c. Drawing Compliance: A letter shall be provided stating that the Audio-Video installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE OWNER.

C. Close-out Procedures:

1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. The close out submittals shall include:
   a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
   b. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
   c. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
   d. The manual shall also include Manufacturer’s data sheets and installation manuals/instructions for all equipment installed, a list of recommended spare parts.
   e. Generic or typical owner’s instruction and operation manual shall not be acceptable to fulfill this requirement.
   f. An up-to-date record (“as-built”) set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the Audio-Video system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
   g. As-built Drawings shall include cable pathways, and device locations with correct labeling. The as-built drawings shall be prepared using AutoCAD 2021 or later. Provide the Owner with electronic versions of the as-builts on 2 quantity 8GB thumb drive media.
   h. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
   i. A copy of the manufacturer’s warranty on the installed system.
   j. 5 sets of keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
   k. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
   l. Quick-start Guide for each system written with the assumption that the intended reader is technically inexperienced and unfamiliar with the facility. Quick-start Guide shall be provided in hard-copy format and in pdf format on an 8GB thumbdrive with the close-out documentation.
   m. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner’s operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 8 hours in four 2-hour sessions.
   n. Contractor shall video record training sessions and include videos in close-out documentation in DVD format.

PART 2 - PRODUCTS

2.1 GENERAL

ALL PRODUCTS LISTED IN THIS SECTION SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR.

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable EIA/BICSI standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the EIA/BICSI specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect/Engineer to review.

C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.

D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
1. Approved Products
a. Twisted-pair cable: Dyna-Blue
American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
1. Approved Products
i. Wiremold Flamestopper - #FS4R-RED
ii. Precut 4" conduit - #FSPCC4758

2.1 ADDITIONAL PARTS

A. Provide all materials listed in this specification section to furnish the media infrastructure from input component to output component, to furnish all classroom presentation system locations identified in drawings. Any change orders issued during the course of this project shall pull materials from this additional stock until the stock is depleted. In the event that that such stock is remaining upon the completion of the project, the contractor shall deliver the excess to the owner for attic stock.

2.2 CABLE ROUTING/PATHWAY

A. Cable Support System: All audio-video cabling shall be installed and supported using a Caddy Cable Cat or Arlington Loop cable support system at 4'-0" intervals unless installed in conduit. Do not exceed manufacture recommendation for the quantity of cables supported in an individual support.
B. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

2.3 INTEGRATED FLAT PANEL MONITOR (indicated as 'SMBD' on drawings)

A. Provide SMART Board MX275 with IQ in each Classroom and Conference Room. Provide 5-year warranty.
B. Provide SMART Board MX286 with IQ in each Fine Arts Classroom, Music Rooms, LGI, Computer Labs, Science Labs, Library and all other non-Classroom / Conference Room space. Provide 5-year warranty.
C. Provide 1 qty. Balance Box 400 height adjustable mount for each wall mount display.
D. Quantity as shown on drawings.
E. Provide 1 qty. Peerless SR598 Panel Cart with Peerless ACC-LA laptop arm in locations shown on drawings.
F. Provide all software required and interminable licences for each display. All software and licenses shall be the explicit property of Lamar Consolidated Independent School District.

2.4 LCD DISPLAYS (indicated as 'LCD' on drawings)

A. Provide Samsung QN90F Neo QLED 4K. 55", 75" and 95" display or approved equal
B. Provide ChiefMFG #TS525TU, Large Dual Swing Arm Mount.

2.5 CLASSROOM AUDIO / VIDEO SYSTEM

A. Provide all software necessary to access full functionality of the system. All devices shall be licensed to the Owner without further chargers or recurring license fees
B. The System is to include all equipment, cabling, materials, labor, and training as required to install and test a complete operating System as described herein.
C. Contractor shall follow installation instructions provided by the manufacturer. Installation drawings shall show the location and general arrangement of equipment, electrical systems, and related items. They shall be followed as closely as elements of the construction will permit.
D. Contractor shall examine the installation drawings and verify the conditions governing the work on the job site. Contractor shall arrange accordingly, providing such fittings, horizontal cable raceways, conduits, junction boxes and accessories as may be required to meet such conditions.
E. Deviations from the installation drawings, except for minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the Systems, shall not be made without the written approval of the Engineer.

2.6 MANUFACTURER

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of FrontRow Calypso LLC, 1609 Corporate Circle, Petaluma, CA 94954, Phone +1 707 227 0735, www.gofrontrow.com. The parts numbers in numeral 2.5 below correspond to the kit order number, which includes cables and accessories that are necessary to meet the performance criteria. Substitution request to follow procedure setup in General Conditions and to be approved by the Owner Representative 15 days prior to Bid date.

2.7 CLASSROOM AV SYSTEM COMPONENTS

A. **CEILING APPLICATION.** In classrooms with Drop Ceiling Tiles, the AV equipment must be housed in a 2’ X 2’ lockable, lab certified plenum-rated enclosure. The basis of design is FrontRow #1000-00206 ezRoom Voice Trio (ELEVATE) with Classlight, CM900, TB14, ELEVATE MIC RECEIVER, POE-X, TP-LINK, CM-BT, which consists of the following system components:

1. 1000-00206 ezRoom Voice Trio (ELEVATE) with Classlight, CM900, TB14, ELEVATE MIC RECEIVER, POE-X, TP-LINK, CM-BT in a 2x2ft plenum rated ceiling enclosure. Designed for drop ceilings, includes mounting hardware.
2. 1000-00183 Action! Teacher Microphone (ELEVATE)
3. 1000-00199 FlipCharger (ELEVATE)
4. CB-2050 Keypad and Rotary Control Panel Kit (Control; Cable)Decora® style dual-gang rotary volume control + keypad control panel with 8 customizable keys.
5. 1010-00088 Preinstalled CMBT Bluetooth Receiver (CM900/ELEVATE).
6. 1000-00153950CS Ceiling Sensor Kit (Sensor; Cable)
7. 6414-00028 Audio Cable; 3.5mm male - 3.5mm male; plenum-rated; 15m/50FT
8. 1000-00192 Bravo! Student Microphone (ELEVATE)
9. 6416-00137 Active Optical HDMI Cable.
10. 6414-00139 HDMI Pass-Through EDID Emulator.
11. 6414-00027 USB Cable; built-in repeater.
12. 2 qty. 6414-00028 3.5mm Audio Cable

B. **WALL APPLICATION**. In classrooms with open ceilings or hard-lid ceilings, the AV equipment must be housed in a wall surface enclosure. The basis of design is 1000-00230 ezRoom Voice & Alert WallCore (ELEVATE) with Classlight, CM900, TB14, ELEVATE MIC RECEIVER, POE-X, TP-LINK, CM-BT. with the following system components:

1. 1000-00230 ezRoom Voice & Alert WallCore (ELEVATE) with Classlight, CM900, TB14, ELEVATE MIC RECEIVER, POE-X, TP-LINK, CM-BT in a deep wall mount enclosure with dual gang opening for FrontRow control option.
2. 1000-00183 Action! Teacher Microphone (ELEVATE)
3. 1000-00199 FlipCharger (ELEVATE)
4. 1010-00088 Preinstalled CMBT Bluetooth Receiver (CM900/ELEVATE).
5. 202-05-001-00 WALL, Speakers, Pair, Unit Assemblies; with 6436-00021 Speaker Cables (2-pack)
6. 6414-00028 Audio Cable; 3.5mm male - 3.5mm male; plenum-rated; 15m/50FT
7. CB-2050 Keypad and Rotary Control Panel Kit (Control; Cable)Decora® style dual-gang rotary volume control + keypad control panel with 8 customizable keys.
8. 1000-00192 Bravo! Student Microphone (ELEVATE)
9. 1010-00088 Preinstalled CMBT Bluetooth Receiver (CM900/ELEVATE).
10. 6416-00137 Active Optical HDMI Cable.
11. 6414-00139 HDMI Pass-Through EDID Emulator.
12. 6414-00027 USB Cable; built-in repeater.
13. 2 qty. 6414-00028 3.5mm Audio Cable

C. Provide for each room equipped with a FrontRow system:

1. ‘HDMI’ and / or ‘PS’ Outlet. All cabling shall be routed and connect to ‘CMP’ and / or ‘SMBD’ and / or 'LCD' device.
    a. (1) C2G # 39873 wall plate with the following connectors:
        i. 3.5 mm audio jack pass-through. Label “INPUT”
        ii. HDMI type A pass-through. Label “HDMI”
        iii. USB type B pass-through. Label “USB”
    b. (1) RDL # D-MJPT, 3.5mm decora pass through panel.
        i. Label panel, “OUTPUT”.

c. (1) HDE 50' USB 2.0 Type A Male to A Female Extension Cable with Active Repeater (50 FT).
d. HDMI OPTICAL FRONTROW #6414-00052 (‘HDMI’ / ‘PS’ Outlet to WMP or LCD)
e. Or approved equivalent
f. Label the RDL device using the manufacturer provided labeling system as indicated on their website.
g. Label other faceplates with a vinyl adhesive machine printed label, black lettering with white background.

2. 'WMP' and 'LCD' Outlet.
   a. (1) single gang decora brush plate (white).

3. Provide for each classroom for instructor's media source connectivity:
   a. (1) Liberty #RVHDRAD15FT, 15’ 4K HDMI cable with 90 degree connector
   b. (2) C2G # 40414, 3.5mm M/M stereo audio cable, 12’ long.
   c. (1) installer Parts 15 ft USB 2.0 High Speed Cable -- A-Male to A-Male – Black
   d. Or approved equivalent

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor is required to properly mount projector and connect all ceiling video/audio cables to projector component inputs.

B. Contractor is required to thoroughly test and verify operation of all projector inputs and video modes prior to project completion.

C. Contractor is required to focus and adjust projector to properly project image on viewing surface (screen or multimedia board depending on location).

D. Contractor shall provide owner with written verification test process and results once all projectors have been installed, tested, and placed in final condition.

E. Damage:
   1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1/4 inches).

F. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

G. Clean Up:
   1. All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

A. Contractor shall provide owner with detailed serial number listing and associated graphical room number designation equipment was installed. Contractor shall use actual graphical package room numbers not architectural plan numbers from construction set.

3.3 STATION WIRING INSTALLATION

A. General:
   1. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed enhanced Category 6 UTP cable at either the wiring closet or the workstation termination locations.

B. Exposed Cable:
   1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings.
      Additional exposed cable runs will require Owner approval, and will only be allowed when no other options exist.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:
   1. All cabling placed in ceiling areas must be in conduit, cable tray or Caddy Cable Cat or Arlington Loop cable support. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed.

   2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.

   3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install audio-video cabling.

3.4 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be mounted in a faceplate with back box.

B. Placement: As shown on drawings.

3.5 TESTING, CERTIFICATION, WARRANTY, SERVICE

A. A factory trained service technician shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect, Engineer, and local authorities. Testing shall ensure the following:
   1. Before energizing the cables and wires, check for correct connections and test for short-circuits, ground faults, continuity, and insulation.
   2. Complete and functional system.
   3. Installed in accordance with manufacturer's instructions.

4. Upon completion of the testing, the manufacturer or his representative shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with this specification.

B. The contractor shall provide a warranty for the installed system. The warranty shall be against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one year warranty or manufacturer's warranty whichever is greater.

C. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

3.6 DRAWINGS, MANUALS AND TRAINING

A. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Include copies of all programming sheets used to configure the system.

B. The Contractor shall conduct formal on-site training sessions. Provide documented general instruction as follows:
   1. Provide instruction to District personnel to include the location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of four (8) hours -- four 2-hour sessions separated by a minimum of two weeks.
   2. Provide instruction to designated personnel on the functions and operation of the intercom and master clock system including emergency and service request procedures. Provide a minimum of four (4) hours--two 2-hour sessions separated by a minimum of two weeks.

END OF SECTION

SECTION 27 51 24 – SCHOOL COMMUNICATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The requirements of the General Conditions, Supplementary Conditions, Division 1, and Drawings apply to all Work herein.
B. The basis of system components, without total numbers, are based on the quote # ES317962, from Boxlight Inc. this baseline quote does not reflect the total amount of each component. Contractors will be required to do final component counts based on the plans provided and apply that amount accordingly.

1.02 SCOPE

A. General: Furnish and install a FrontRow™ Conductor integrated communications / clock and bell system with all equipment, accessories, cabling, devices, and materials in accordance with the project specifications and drawings to ensure a fully operational and intelligible intercom, master clock, secondary clock, and class change time tone communication system of the highest quality.

B. It shall be the responsibility of the Electrical contractor to provide and install all conduit systems, standard electrical boxes, and operating power for the communication system as outlined on the project drawings.

C. The Intercom Communication System Contractor (Contractor) shall coordinate all system requirements.

D. Equipment specified herein is designed to provide specific functional and operational characteristics. It is the responsibility of the Intercom System Contractor to provide all features and functions as outlined in these specifications.

E. The contractor shall provide one (1) analog terminal adapter CMP-500 to the building telephone system via a dedicated line. This will provide transparent access from the telephone system to the paging system. In addition, the telephone interface shall support a security code if desired. The telephone interface shall recognize valid DTMF tones as logical paging zone settings.

F. Provide testing, as described in Part 3, for all requirements to be performed with all cable runs and wiring devices in place.

G. Provide a service contract and warranty as outlined in Part 3 of these specifications.

H. Provide all documentation and training as outlined in these specifications.

1.03 RELATED SECTIONS

A. Section 26 05 34 - Provisions for Communication, Security & Safety Systems.
B. Section 27 00 00 – Basic Materials and Methods
C. Section 27 10 00 – Technical Cabling System
D. Section 28 16 00 – Intrusion Detection System

1.04 CODES AND REGULATIONS

A. NFPA 70, National Electrical Code.
B. NFPA 101, Code for Safety to Life from Fire in Buildings and Structures.
C. UL 50, Enclosures for Electrical Equipment.
D. FCC Rules, Part 76.

E. All applicable parts will be FCC Class B approved.
F. Americans with Disabilities Act.
G. Texas Accessibility Standards.
H. International Building Codes (IBC).
I. Local and State Building Codes.
J. All requirements of the local Authority Having Jurisdiction (AHJ).

1.05 CONTRACTOR QUALFICATIONS

A. Contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements described will be disqualified.

B. The Contractor, as a business entity, shall be an authorized distributor and designated representative of the equipment manufacturer, with full warranty privileges. The proposed contractor shall have been actively engaged in the business of selling, installing, and servicing commercial building commercial communication systems for a period of at least 5 years.

C. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.

D. The Contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.

E. The Contractor shall be fully experienced in the design and installation of the type of system herein specified and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150- mile radius of the school district to allow school administration officials to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

F. The Contractor shall employ factory-trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate for this training shall be provided with the contractors' submittal.

G. The Contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response. A Proposed Contractor that has any prior finding(s) of a code violation or has any litigation in process concerning the installation of a communication system is unacceptable.

H. Any discrepancy in quantity or part numbers between the drawings and the bid specifications shall be brought to the attention of the Consultant for clarification during the bidding period. No allowance shall be made to the Contractor because of failure to have brought said discrepancies to the attention of the Consultant prior to award of contract.

I. The Contractor shall provide all necessary patch cables, riser/plenum cabling and connectors interconnecting all equipment to provide for fully functional systems. In addition, all cabling raceways, support systems, sleeves and any other materials required to properly install and support cabling systems.

J. The ability of the Contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

K. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

L. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

M. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfil any part of the contract or to complete the work contemplated therein.

N. The Owner reserves the right to reject the proposal of any Contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

PART 2 – PRODUCTS

2.01 GENERAL

A. All basic equipment for which there are Underwriters' Laboratories' Standard requirements shall be listed by Underwriters' Laboratories and be so labeled, or shall conform to their requirements, in which case, certified statements to the effect shall be furnished by the manufacturer with a copy of an examination report by a recognized laboratory acceptable to the Local Authority Having Jurisdiction.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations and the requirements of the components UL listing. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, electrical requirements, cable types, and physical equipment sizes, etc., before beginning system installation.

C. All data keeping hardware, firmware, and software provided shall be fully compliant with the calendar year designated in four-digit date format. Any time equations must function normally, leap year, and daylight savings time must be supported.

D. All basic equipment shall be new and shall be the latest product of a manufacturer of an established reputation and experience of quality electronic equipment. Model numbers indicate current equipment types; if later models exist, the Contractor shall provide those. The manufacturer shall have supplied a similar apparatus to comparable installations rendering satisfactory service for at least three (3) years.

E. It is the responsibility of the Intercom Communication System Contractor 1 to provide all features and functions as outlined in these specifications. The intercom shall accept standard DTMF signals from the building telephone system through an analog telephony interface #CMP-500.

F. All like devices shall be of the same manufacturer and model number.

G. Only equipment devices have been shown on the contract drawings. Specific wiring between equipment has not been shown.

H. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., speakers shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load with a 5:1 Safety Factor.

I. The installation shall be subject to approval, inspection, and test of the Architect/Engineer.

2.02 ACCEPTABLE MANUFACTURES

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose any product substitution must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified

D. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of alternate products shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure products will be an acceptable equivalent.

E. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

F. The model numbers used shall constitute the quality and performance of the equipment to be furnished. The **Conductor School Communication and Safety System by FrontRow, 1690 Corporate Circle, Petaluma, California** is acceptable basis of design; any other proposed manufactures must be pre-approved.

2.03 RELATED WORK - NETWORK CONNECTIVITY

A. Refer to Section 27 10 00 for all Ethernet network drop connections. All Ethernet cabling and jacks used to connect to the building network shall be provided as indicated on the plans under Section 27 10 00. All system devices provided in this section, which require an Ethernet network connection shall be coordinated with this contractor.

B. All system devices provided in this section that require a network connection shall be coordinated with the District IT department to be assigned TCP/IP configuration settings including a static IP address, domain, gateway, and subnet mask.

C. The intercom system will require streaming devices/server in a single Class C subnet 255.255.255.0 attached to the server primary network port.

D. The contractor shall implement all device network configuration and device programming required to provide a complete and functional system under this specification including any special connecting network jumpers and all other types of cabling, and interconnect wires and cables required.

2.04 INTERCOM AND PUBLIC ADDRESS OPERATION

A. Common zone paging speakers shall serve all corridors, passageways, offices, cafeteria, library, gymnasium, public spaces, exterior, etc.
   1. Interior spaces shall be equipped with intercom ceiling speaker(s) Quam-Nichols Company SYSTEM 5 speaker tapped at 1.25 watts. All corridor speakers shall be on the same zone and tapped at 5 watts. Separate corridor speaker in groups in order to not exceed the wattage rating of the amplifier.
   2. Gymnasium speakers shall be Quam-Nichols Company SYSTEM 1 speaker tapped at 5 watts.
   3. Rooms shown on the drawings with a volume control shall be equipped with a Lowell 25LVC-DW (white). Connect volume control in-line with amplifier source cable to allow for control of the volume of local speaker(s).
   4. Exterior speakers shall be UL listed, flush mounted waterproof type paging speakers for voice and tones with matching transformer. Quantity as shown on plans. Provide AtlasIED APF-15T with 193-8-6 back box and VP161-APF Baffle.
   5. Zone Gymnasium speakers separately.
   6. Zone exterior speakers separately.
   7. Provide and install (1) Ashly NE8250 amplifier for all speakers in section 2.04. A., with the exception of classroom speakers. Connect (1) Front Row CM-800 per amplifier channel in use: 1) Interior Common Areas including corridors, Library and Cafeteria, 2) Gymnasium, 3) Exterior, and program separate zone outputs to appropriate equipment as required.
   8. For each classroom, the Contractor shall furnish and install a complete, networkable, scalable AV control and presentation System.
   9. In classrooms with Acoustical Ceiling Tile, the AV equipment must be housed in a 2’ X 2’ lockable, lab certified plenum-rated enclosure. The basis of design **is FrontRow # 1000-00206 ezRoom Voice & Alert Trio (Elevate),** (by 27 41 16 contractor).
   10. For classrooms with hard or open ceilings, a surface Wallcore enclosure must be provided. The basis of design is **FrontRow # 1000-00231 ezRoom Voice & Alert WallCore Control (Elevate),** (by 27 41 16 contractor).
   11. Software: All software necessary to access full functionality of the system shall be licensed to the Owner without further chargers or recurring license fees
   12. The System is to include all equipment, cabling, materials, labor, and training as required to install and test a complete and operating System as described herein.
   13. The contractor shall follow the installation instructions provided by the manufacturer. Installation drawings shall show the location and general arrangement of equipment, electrical systems, and related items. They shall be followed as closely as elements of the construction will permit.
   14. The contractor shall examine the installation drawings and verify the conditions governing the work on the job site. The contractor shall arrange accordingly, providing such fittings, horizontal cable raceways, conduits, junction boxes and accessories as may be required to meet such conditions.
   15. Deviations from the installation drawings, except for minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the Systems, shall not be made without the written approval of the Engineer.

   16. 1.7 ACTION SUBMITTALS
   17. Product Data: For each type of product required, demonstrating compliance with requirements. Shop Drawings: Indicate the following: Schematic diagram of controlled circuits. Circuits and emergency circuits with capacity and phase, control zones, load type and voltage per circuit.
   18. NOTE: Local A/V systems shall be connected via analog interface (by Local Sound Contractor) to the FrontRow™ Conductor system for the purpose of reinforcing Conductor broadcast audio using a CM-800.

B. All speakers: classroom, office, corridor, exterior, gymnasium, cafeteria, and common areas shall broadcast announcements as zoned. Speakers shall produce clear human voice reproduction at 10 dBA over ambient noise levels minimum (i.e. corridors at class change) but never less than 65 dBA or more than 110 dBA throughout all areas that are typically occupied.

C. Provide as indicated on plans an Intercom Administrative Station #FR-ADMIN to provide the following functions:
   1. Identify incoming calls by their designated classroom numbers. Alert calls shall initiate a distinctive audible alert and visual indication.
   2. Provide facilities for answering calls registered in the display by a single "response" screen button.
   3. Provide the capability to broadcast all-call or zoned paging announcements over all interior, exterior, and corridor speakers. Zone announcements to exterior speakers separately.
   4. The system shall provide facilities for calling a staff (classroom) station by selecting the classroom or other location name from the graphical user interface.
   5. The central microprocessor control equipment shall be of modular design, 1 expandable to 250 stations. All programming shall be accomplished from the graphical user interface. The system shall be equipped with diagnostics logging capability.
   6. The system shall provide the capability of assigning speaker locations to any one or more software programmable zones for zone paging. The number of zones allowed shall not be limited.
   7. Systems amplifiers shall be capable of providing sufficient power for emergency paging of all speakers with a 30 percent reserved capacity for future expansion.
   8. System central control equipment shall be Underwriters Laboratory listed under Commercial Audio Systems and Accessories UL 813 and installed in a 19" rack mount cabinet and located where shown on the drawings or as directed by the Architect.
   9. **Provide an Uninterruptible Power Supply (UPS): Eaton 5PX2000RTNG2 for the #FR-ADMIN.**
   10. The work described by this section includes the furnishing of all components, materials, equipment, installation and technical labor and the performance of all operations necessary for the complete installation of an Intercom - Clock System in operating condition as indicated on the drawings and/or specified herein including:
      a. Licenses, permits as may be applicable
      b. Provision of submittal information
      c. Installation in accordance with contract documents, manufacturers' recommendations and applicable codes
      d. Configuration of control and signal software including custom programming if required Testing and adjustments, including documentation thereof
      e. Provision of manuals
      f. Maintenance and warranty services
   11. **PRIOR TO THE FRONTROW SOFTWARE BEING INSTALLED, THE CONTRACTOR SHALL PROVIDE THE FR ADMIN DEVICES TO THE DISTRICT FOR THE IT DEPARTMENT TO IMAGE.**

2.05 RACK / ENCLOSURE

A. Provide and install (1) Chatsworth CUBE-It PLUS Wall Mounted rack # 13492-772
   1. 72” high, 24” deep, 40RU with metal door, black.
   2. Install at location shown on drawings.
   3. Provide with rack, (1) SurgeX SX-1115-RT, rack mounted power distribution / surge protection.

2.06 AUDIO PROGRAM SOURCE

A. Provide (1) Denon DN300Z AM/FM, Bluetooth, Tuner/CD or approved equivalent to connect via dual RCA to 3.5 mm patch cable and dual XLR to 3.5 mm to the Master CM900 network controller.
    1. Provide RDL STD-600 for balanced stereo connection to Master CM900.

2.07 TELEPHONE SYSTEM INTERFACE FUNCTIONS

A. The functions described below are accomplished through the connection of the paging system to a Universal Telephone Interface (kit # CMP-500) to the building telephone system through a dedicated land line to allow telephone to access to this port.

B. In order for these functions to operate, the Owner must provide a dedicated telephone line.

C. Any system telephone shall be able to page on an all-call, and zone basis to any of the programmed paging zones.

D. Any administrative system telephone shall be able to initiate an emergency announcement to all locations. Emergency announcements override all other programs.

E. Any system telephone shall be able to initiate emergency evacuation voice announcements and/or pre-recorded emergency tones and signals.

2.08 MASTER CLOCK SYSTEM

A. The master clock system shall include an easy-to-use web-based interface that allows for configuration via the Internet or LAN/WAN and Internet NTP / UTC World Time Clock Synchronization.

B. Clocks shall be placed as shown on drawings – Sapling #SAP-4BS-12R-0-A1 (12” round, black plastic case, standard 12 hour face).
    1. **Dual face clock:** (2) Sapling #SAP-4BS-12R-0-A1 with (1) Sapling SAH-4BD-12R-0 double mount.

C. Internet UTC World Time Clock Synchronization: Provide World Time Clock Synchronization for the master clock system. Contractor must program Conductor’s time source to the same internet UTC.

D. Provide one (1) PoE yellow CAT6A UTP to each clock (for power and time signal) from Owner provided PoE network switches at MDF/IDF’s.

E. Load Sapling clock software on FrontRow Admin Station computer/display for clock control.

2.09 INTERCOM SYSTEM HEADEND EQUIPMENT

A. Mount all equipment, except portable equipment, firmly in place. Permanently mark all cables and install in a professional, neat, and orderly installation. All wiring and cables will be securely fastened and routed using Velcro strips and/or wire ties. Provide for adequate ventilation in all equipment racks and take precautions to prevent electromagnetic or electrostatic hum. Insert test results in the owner's manual.

B. Provide the components necessary to provide a complete integrated system performing to the above specifications. FrontRow Conductor IP Intercom System as herein listed.

C. The intercom system shall contain all internal components to allow connection of 30% spare intercom circuits. Equipment list, quantities as required, shall consist of but not be limited to:

1. FrontRow DRS5000 Rack Mount Server (1RU) running:
    a. FrontRow Conductor software database
    b. FrontRow Maestro asset management software
    c. FrontRow Encore software management
    d. FrontRow Time Sync Software

D. FrontRow CMP-500 Universal Telephone Interface

E. FrontRow CM-800 Audio Decoder

F. Inputs and Balanced/Unbalanced Output

G. Uninterruptible power supply (included with #FR-ADMN)

The parts described above for the FrontRow Admin Station are classified in the following kits:

1. #FR-ADMIN: Includes complete office station for Conductor communications. It consists of all-in-one touch PC with preloaded software; CM900 master controller; CB65 microphone; UPS battery backup; wireless keyboard & mouse; mousepad; printed user guide; one audio to USB adapter.

2. #DRS-5000: 1U Linux based server with power supply. It includes license for Maestro network management software; Encore licensing and updating service; FrontRow control panel Timesync service and one Flashback USB drive.

2.10 FAST ETHERNET POE SWITCHES FOR INTERCOM ANNOUNCEMENT AND AUDIO INTERFACE/AMPLIFIER NETWORK CONNECTIVITY

A. A classroom POE extractor 1010-00005 is required to ensure that the paging/intercom system stays active during a power outage. For non-classroom paging areas the network switch must provide a minimum POE standard of 802.3af for each 1010-00005 device. In addition, all relevant network switches, routers, etc. must be supported by a local UPS.

2.11 ADMINISTRATOR STATION

A. Provide all equipment necessary for the correct performance of the FrontRow head end system #FR-ADMIN.

2.12 INTERCOM ANNOUNCEMENT AUDIO INTERFACES/AMPLIFIERS:

A. Offices, corridors, and common areas – Provide per section 2.04. above as required.

2.13 CABLE

A. The Contractor shall provide and install new and unused ASTM bare solid copper conductor wire per ANSI/NEMA codes. Follow the manufacturer's instructions. All wire shall be UL listed for communication and control circuits.

B. All cables shall have a label on both ends utilizing self-laminating, nylon or vinyl printed labels. Handwritten labels are not acceptable.
    1. Brady or equivalent.

C. Each call button shall be wired with Category 6 cable.
    1. Plenum cable shall be used where required.

D. Each speaker cable shall be NEC type CMR, West Penn Wire No. 225, 16 AWG, two (2) conductors. Equivalent by Belden, Carol, or Comtran.
    1. Plenum cable shall be used where required.

2.14 CABLE TIES

A. Nylon cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required.
    1. Nylon wire tie, 3.9”, miniature - Panduit PLT1M-C or equivalent.
    2. Nylon wire tie, 5.6”, miniature - Panduit PLT1.5M-C or equivalent.
    3. Nylon wire tie, 11.4”, intermediate - Panduit PLT3I-C or equivalent.
    4. Nylon wire tie, 14.6”, intermediate - Panduit PLT4I-C or equivalent.

2.15 CABLE ROUTING, INSTALLATION, AND SUPPORT

A. System wiring and equipment installation shall be in accordance with good engineering practices as established by the NEC and TIA/EIA. Wiring shall meet all state and local electrical code requirements.

B. Cable pathways, conduit, and cable support systems shall be complete with bushings, deburred, cleaned, and secure prior to installation of cable.

C. All wiring shall be tested free from opens, grounds, or shorts. All communication cables shall be supported from the building structure and bundled. Do not attach any support to joist bridging or other lightweight members.

D. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

E. In all open exposed areas such as gymnasiums, shops, field houses, janitors’ closets, or mechanical / electrical rooms, all the communication cable shall be fully enclosed in conduit.

F. Communication cables shall be run in trays from wall boxes to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.

G. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

H. Communication cables shall be run in bundles above accessible ceilings and supported by building structure. Cabling shall be loosely bundled with cable ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.

I. Communication cable must not be fastened to electrical conduits, mechanical ductwork/piping; sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel for more than four feet with line voltage electrical conductors. Communication cables shall not be run loose on ceiling grid or ceiling tiles.

J. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting

or removing ceiling tiles. The cable pathway of support must be positioned at least 12 inches above the ceiling grid.

K. All cabling shall be placed regarding the environment, EMI/RFI interference, and its effect on communication signal transmission.

L. Do not route any data communication cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

M. Communication cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirement.

N. Maximum cable pulling tension should not exceed 25 lb./ft. or manufactures recommendation, whichever is less.

O. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

P. No terminations or splices shall be installed in or above ceilings.

Q. Cable bends shall not be tighter that the manufacturers' suggested bend radius.

R. Mount all equipment firmly in place such that vibration or jarring will not activate an alarm, supervisory, or trouble signal. Route cable in a professional, neat, and orderly installation.

S. All cables shall have a label on both ends utilizing self-laminating, nylon or vinyl printed labels. Handwritten labels are not acceptable.
   1. Brady or equivalent.

T. Each cable run shall include a five-foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.

U. Provide for adequate ventilation to all equipment racks and take precautions to prevent electromagnetic or electrostatic hum.

V. All conduit, ducts, track, and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices. Cable fill may not exceed the manufacturers' instructions for each type of support.

W. Devices mounted on a drop ceiling shall feature a backbox fitted with a support hanger (Caddy #512 or #512A for deep boxes), or equivalent with independent drop wires to support the weight of the device.

2.16 TERMINATION PRACTICES

A. Strip back only as much cable jacket as required to terminate.

B. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

C. Avoid twisting cable jacket during installation.

2.17 BUSHINGS

A. Provide a plastic snap in bushing at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves prior to cable installation to protect the cabling from damage:
    1. Box openings - Thomas & Betts Knockout Bushing Series 3210, or equivalent.
    2. Metal stud passage - Thomas & Betts Twist It Bushing Catalog Number SB1216-SC or equivalent.
    3. Conduit ends - Thomas & Betts Anti-Short Bushing Series 390 or Tite-Bite Combination couplings Series 442, or equivalent.

2.18 J-HOOKS

A. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:
    1. Single cables or bundles up to four cables may be supported directly by the building structure.
    2. Bundles up to 1/2" dia. (Ten 1/4" cables) 2" bridle ring, Caddy #4BRT32 or equivalent.
    3. Bundles up to 3/4" dia. (Sixteen 1/4" cables) 3/4" J-Hook, Caddy #CAT12 or equivalent.
    4. Bundles up to 1-5/16" dia. (Fifty 1/4" cables) 1-5/16" J-Hook, Caddy #CAT21 or equivalent.
    5. Bundles up to 2" dia. (Eighty 1/4" cables) 2" J-Hook, 1 Caddy #CAT32 or equivalent.
    6. Split bundles greater than 2" dia. or provide cable tray.

B. Do not mix different signal strength cables on the same J-Hook (i.e. intercom with telephone/data cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

2.19 SURGE AND AMPERAGE PROTECTION

A. Electrical surge protection shall be provided for all service entrance connections and on each copper pair that connects one building to another (i.e. any other portion of a building complex not under one continuous roof) at both exit points to prevent damage to equipment.

2.20 FIRE STOPPING, DRAFT/NOISE STOPPING, PENETRATIONS, AND CORING

A. UL Listed fire stopping methods that match the fire rating of the wall or floor being penetrated are to be used at all fire barrier penetrations. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with firestop caulk or putty, install according to the manufacturers' instructions.

B. All penetrations through fire rated walls or floors shall feature a suitable length of metal conduit. Hole diameter shall not exceed ½" larger than the conduit or sleeve to be installed. The hole shall be neatly cut, not oversized or irregular. Do not share wall/floor penetrations with ductwork, piping, line voltage electrical conduits, etc.

C. All gypsum board or plaster penetrations shall be tool cut using an appropriate hole saw / mandrel or manufactured assembly.

D. Draft/Noise Stopping - All penetrations through non-rated walls shall include draft/noise stopping to minimize the transfer of air and sound between enclosed areas. This shall include but not limited to:
    1. Neatly cutting all non-rated wall penetrations with a 1" maximum clearance. All gypsum board or plaster penetrations shall be tool cut using an appropriate hole saw / mandrel or manufactured assembly. The hole shall be neatly cut and not oversized or irregular. Do not share wall penetrations with other types of ductwork, piping, line voltage electrical conduits, communications cabling, etc.
    2. Provide and install non-combustible mineral wool, fiberglass, cellulose insulation, caulk, and/or sealant as required. Seal the interior of conduit sleeves around the cables and around the outside of the sleeve on each side of the penetration with caulk or putty, install materials

according to the manufacturers' instructions.

E. The Contractor shall make every effort to coordinate with the building Architect, Engineer, Builder, and Electrical Contractor to have sleeves placed in new construction so that later coring or drilling of building structural members will not be required. The Contractor must consult with the building Architect, Engineer, and Builder prior to drilling, coring, or sawing of any wall, floor, etc. All penetrations shall be done at approved, appropriate, locations.

F. Upon approval, the Contractor shall be required to supply all labor, equipment, tools, and materials to create any additional penetrations, and shall provide the sleeve, temporary and final fire stopping. Special care shall be taken not to stress, overheat, or penetrate any building support member. Coring shall be made with equipment appropriate for the dry penetration of concrete and block materials. Under no circumstances shall penetration be made utilizing chisel or percussion type equipment. Concrete, block, or plaster cores shall be made by dry saw/core methods only.

PART 3 - EXECUTION

3.01 OCCUPANCY ADJUSTMENTS

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

3.02 TESTING, CERTIFICATION, WARRANTY, SERVICE

A. A factory trained service technician shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect, Engineer, and local authorities. Testing shall ensure the following:
   1. Before energizing the cables and wires, check for correct connections and test for short-circuits, ground faults, continuity, and insulation.
   2. Complete and functional system.
   3. Installed in accordance with manufacturer's instructions.
   4. Upon completion of the testing, the manufacturer or his representative shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that the system is in compliance with this specification.

B. The contractor shall provide a warranty and service contract for the installed system. The warranty shall be against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one-year warranty or manufacturer's warranty whichever is greater.

C. The service contract shall provide a minimum of the following:
   1. Diagnostics of the system should a problem occur.
   2. Reprogramming - Desired changes to class of service of any device or to the bell schedule. The Intercom Communications System Contractor will provide this service with an unlimited number or frequency of the changes.
   3. The Communication Systems Contractor will provide service software upgrades to the system that becomes effective during the period of the service contract.

D. The contractor shall make available a service contract offering continuing factory authorized service of this system after the initial warranty period. This contract shall automatically renew each year at the owner's discretion. The contractor will provide the cost of renewal 1 to the owner thirty (30) days prior to the expiration of the contract after the first year.

E. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

3.03 DRAWINGS, MANUALS AND TRAINING

A. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Include copies of all programming sheets used to configure the system.

B. The Contractor shall conduct formal on-site training sessions. Provide documented general instruction as follows:
   1. Provide instruction to District personnel to include the location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of four (8) hours -- four 2-hour sessions separated by a minimum of two weeks.
   2. Provide instructions to designated personnel on the functions and operation of the intercom and master clock system including emergency and service request procedures. Provide a minimum of four (4) hours--two 2-hour sessions separated by a minimum of two weeks.

END OF SECTION

SECTION 27 51 23.80 – LOCAL SOUND REINFORCING SYSTEMS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Provide all materials, equipment, transportation and labor to achieve complete and fully functional systems as shown or intended on drawings and in bid specifications.

B. All applicable equipment shall bear the UL label. All work shall be executed in accordance with the National Electric Code (NEC), the Occupational Safety and Health Act (OSHA) and all applicable State and Local codes, ordinances and regulations.

C. The Contractor's installation team shall have at least one member possessing a NICET Level II, CTS-I or C-EST certification; additionally, at least one audio DSP programmer certified in HiQnet Audio Architect, Symetrix, Biamp Tisera, QSC Q-SYS or Dante.

D. Contractor shall have been in the commercial AVL (Audio, Video, Lighting) installation industry for at least five years. Contractor shall have installed at least five systems of this type and comparable scale in educational facilities within the State of Texas. Contractor shall provide a list of successfully completed projects including completion dates within the past two years from the bid date of this project.

E. Should the local sound systems include Crestron or AMX hardware which requires programming, the Contractor shall provide a Certified Crestron Programmer or an AMX Certified Expert (ACE) Programmer to program, upload and debug the third party control systems.

F. Should the local sound systems include managed network devices, the Contractor shall provide one person on the installation team with valid certification in one of the following: Harman HCNA/P, CompTIA Network+, Cisco CCNA or Cisco CCNP. Provide valid certification credentials in the submittal documentation.

G. Any discrepancy in quantity or part numbers between the drawings and the bid specifications shall be brought to the attention of the Consultant for clarification during the bidding period. No allowance shall be made to the Contractor by reason of failure to have brought said discrepancies to the attention of the Consultant prior to award of contract. Should discrepancies be discovered, the greater in quality and quantity shown shall be provided.

H. Systems to be installed in the following areas:

1. As listed below.

1.2 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
2. 2015 National Electrical Code

B. Other References:
1. TIA/EIA-568-A – Commercial Building Telecommunications Wiring Standard
2. EIA/TIA-569 – Commercial Building Standard for Telecommunication Pathways and Spaces.

3. TIA/EIA-606 – The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
4. TIA/EIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA 455-A – Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
6. TIA/EIA TSB 67 – Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
7. TIA/EIA TSB 72 – Centralized Optical Fiber Cabling Guidelines
8. ISO/IEC 1180 – Generic Cabling Standard
9. EN 50173 – Generic Cabling Standards for Customer Premises
10. ANSI/EIA/TIA 526-14 – Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts:
   1. If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.3 ABBREVIATIONS

A. The following abbreviations are used in this document:

1.4 SUBMITTAL DOCUMENTATION

A. Submit shop drawings as specified in pdf format, ARCH E1 (30x42). Contractor shall be responsible for all costs associated with producing and submitting all required documentation.

B. Submit a room by room list of all equipment to be installed, in pdf format.

C. Submit Manufacturer's product data for all equipment with a table of contents, in pdf format.

D. Submit a line item compliance statement indicating that the products being submitted comply with the specified equipment and indicate which products deviate from the specifications.

E. Submit detailed drawings of all systems, minimum scale 1/8" = 1', in pdf format.

   1. Table of Contents.
   2. Rigging details. All hardware must meet or exceed a safety factor of 5:1. Detail the product manufacturer, part numbers and load capacity of all hardware to be used. **Contractor shall employ the services of a professional structural engineer licensed to practice in the State of Texas to verify load ratings of hanging components. Provide attachment details on Shop / Submittal Drawings reviewed by said engineer. Include stamped report of items reviewed by structural engineer with shop drawings submittal. Report shall include an itemization of items reviewed by the structural engineer and confirmation that proposed methods of suseending equipment as shown on the shop drawings conform with required safety factors.**

3. Floor Plans, Reflected Ceiling Plans and Section Elevations displaying loudspeaker locations and orientation, wall plate locations, rack locations, 120vAC receptacle locations and all other related device locations.
4. Comprehensive system schematics displaying detailed connections to all equipment. These shall display wire numbers, terminal block numbers, patch bay assignments and color coding.
5. Proposed construction details for any custom fabricated items; including interface panels, patch panels and wall plates. These shall display dimensions, materials, finishes, I/O connector labels and color selection.
6. Rack elevations displaying the locations of all equipment within each rack.
7. Riser diagrams displaying conduit requirements with pull boxes, outlet boxes, cable layouts, cable type part numbers and quantity of cables with part number in each conduit.
8. Electrical power requirements for the systems. Include diagrams for any remote control of electrical power displaying locations and elevations for all receptacles in detail sufficient to coordinate with the Electrical Contractor.
9. All submittal drawings not meeting the above criteria shall be deemed incomplete, shall not be reviewed and shall be returned for revision.

1.5 OPERATING AND MAINTENANCE MANUALS

A. Provide Operating and Maintenance Manuals as specified in Division 26 and Division One and deliver to the Owner.

B. Include:

1. Product Data.
   a. Manufacturer's data for each type of product conforming to the submission format specified herein. Include manufacturer's serial numbers within the list of product.
   b. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
   c. Each product's Owner Instruction Manual. Provide high quality copies where necessary, with all text legible and illustrations of equal resolution and sharpness as the original manual. Faxed copies or copies with portions of the information missing or smeared are not acceptable.
   d. Manufacturer's maintenance and care instructions.
   e. Separately bound list by manufacturer and model or part number of product incorporated within the systems arranged in alphanumeric order. Manufacturer's warranty statements bound separately where applicable.
2. A complete as-installed (As Built) equipment list, listed by room, identifying manufacturers' names, model numbers, serial numbers, quantities and locations of each item.
3. Complete and correct As Built systems schematics, floor plans, reflected ceiling plans, elevations, rack risers and I/O plate details. Include diagrams or charts displaying final settings of all control knobs in the system (mixers, equalizers, audio amplifiers, etc.).
4. Each individual system's program software / source code (audio, video, lighting and third party control) with final settings and pass codes and As Built AutoCAD files (2013 or newer) shall be saved onto two separate 8GB thumb drives and included in the close-out documentation. All software programs / source codes are the intellectual property of the Owner.
5. Quick-start Guide for each system written with the assumption that the intended reader is technically inexperienced and unfamiliar with the facility. The Quick-start Guide shall be laminated and affixed to the inside of the front door of the system rack with appropriate mounting hardware. One copy of each individual

system schematics printed in ARCH D (24x36) and laminated shall be delivered to the Owner.

6. Two hard copy, paper sets of the as-installed (As Built) drawings in ARCH E1. Drawing sets shall be individually bound.
7. In addition to the hard copy close-out documentation, all close-out documentation shall be included, in pdf format, on the, 8GB thumb drives.
8. Service & Maintenance Manual:
   a. Provide an original manufacturer's copy of the service manual on every piece of equipment for which the manufacturer offers a service manual. On equipment where there is no service manual, provide statement from company indicating manual is not available. Arrange manuals in the same order as the operations manual.
   b. Manufacturer's maintenance and care instructions.
   c. Maintenance Instructions, including maintenance phone numbers and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
9. Organize documents into separate bindings containing data relevant to operation, maintenance and warranty.

1.6 WARRANTY AND SERVICE

A. The Contractor shall warrant all new equipment to be free of defects in materials and workmanship for not less than one year after the Substantial Completion date.

B. The systems are to be free of defects and deficiencies and are to conform to the drawings and specifications as to kind, quality, function and characteristics. The Contractor shall repair or replace defects which may occur in labor or materials within the warranty period without charge to the Owner.

C. Within the warranty period, respond to requests for service within 24 hours. Service calls to perform warranty work shall be made within 72 hours of request by the Owner. Temporary, equivalent replacement equipment shall be provided at no cost to the Owner when immediate on-site repairs cannot be made.

D. This warranty shall not void or replace individual manufacturer warranties which extend past this warranty period. This warranty shall not void any rights guaranteed the Owner by law.

E. The Contractor shall include in the close-out documentation a certificate of warranty which includes the start and end dates of the warranty and contact information, including name, telephone number and email, of individuals to perform warranty service.

F. This warranty shall not apply to existing Owner Furnished Equipment.

G. Additional warranties may be negotiated between the Contractor and the Owner at the Owner’s discretion.

1.7 SUMMARY OF WORK

A. The installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications.
   1. Reference project drawings for locations, quantities, and coordination with other trades.

B. All local sound racks shall have cabling installed and routed according to industry standard best practices. Contractor shall employ horizontal lacing rails in the rear of the rack for neat

and orderly cable routing. Use Velcro strips for cable bundling. ZIP TIES ARE NOT ACCEPTABLE.

C. Contractor shall perform an RF scan and shall provide results in pdf format with the close-out documentation. Contractor shall provide an RF coordination sheet, documenting all RF frequencies in use in each system, including in the High School buildings, to ensure there is no RF interference between systems. Coordinate with General Contractor and for access to High School building systems.

D. Contractor shall tune each system's DSP to provide a flat frequency response.

1. Tune and set dynamics on all inputs to provide the highest level of gain before feedback while providing intelligibility of all inputs.
2. Contractor shall perform a "rattle test" of all systems: Apply sine wave sweep signal to each loudspeaker system with a two minute sweep from 20Hz to 550Hz, to 10 - 15dB below full system output. Annotate issues discovered during sweep test. Correct issues resulting from the new system equipment and / or rigging hardware.

E. Contractor shall provide all required equipment and programming to provide a fire alarm override. All audio shall mute in all local sound systems during a fire alarm.

F. Contractor shall Coordinate with District IT department to provide internet access to each QSC QSYS core for QSYS Reflect Enterprise Manager.

G. Contractor shall Coordinate with District IT department to provide a VLAN for the AV system.

PART 2 – MATERIALS

A. All equipment shall be new and unused unless otherwise noted.

B. Contractor shall provide all necessary patch cables, riser/plenum cabling and connectors interconnecting all equipment to provide for fully functional systems. In addition, all cabling raceway, support systems, sleeves and any other materials required to properly install and support cabling systems.

C. All equipment quantities shall be as shown on drawings unless otherwise noted.

D. All materials are to be provided as specified. No substitutions shall be accepted without written request from the Contractor and written consent of the Consultant.

2.1 GYMNASIUM E100

A. AV NETWORDK PERIPHIALS AND I/O

1. 1 qty. QSC TSC-101-G3 – "TSC" - Touch screen controller panel UCI
   a. 1 qty. Honeywell CG512A1009 Large Thermostat Guard
   b. Provide 5 sets of keys
   c. Install in local sound rack.

2. 2 qty. WALL PLATE AUDIO - "WPA".
   a. QSC UNDX2IO+, Two (2) mic/line inputs, two (2) line outputs.
      i. ProCo double gang decora wall plate cover.
   b. Label plate Inputs "MIC 1 – MIC #".
   c. Label plate Outputs "OUT 1 – OUT #".

d. Cover up manufacturers factory IN/OUT labels.
e. Install plates, ascending in mic # from low to high from house left to house right.
f. Quantity and locations as shown on drawings.

3. 1 qty. BT WALL PLATE, - “BT”.
   a. 1 QSC UND610-BT – dante, bluetooth receiver with dual microphone, dual rca, 1/8” aux in and outputs.
   b. Cover up manufacturers factory IN/OUT labels.
   c. Install plates, ascending in mic # from low to high from house left to house right.
   d. Quantity as shown on drawings.

4. Provide all cables required to connect all devices for a fully functional system.
5. 1 qty. Netgear M4250-26G4F-PoE++ (GSM4230UP), 24x1G PoE++ 1,440W 2x1G and 4xSFP Managed Switch.
6. 4 qty. Netgear AGM731F, SFP Transceiver 1000BASE-SX module.
7. 1 qty. ComScope 760162800 | UNP-6A-DM-1U-24, 24 Port Cat6a Patch Panel

B. GRAPHICAL USER INTERFACE / TOUCH PANELS

1. Program QSC Audio System and UCI to allow for control of complete audio matrix routing, input selection, audio level control and mute for each audio input and other such controls as directed by the Owner. Coordinate with Owner and Consultant for final GUI functionality and layout. Coordinate with Owner for Logo to be displayed on splash screen. Provide a numeric (0-9) password page immediately after the splash page. Provide a simple way for Owner to change and store new password from the GUI with a press-and-hold hidden button to access password change page.

2. The first page “SYSTEM START UP” shall have the text, “PRESS ANYWHERE TO START SYSTEM”. The next page shall display a prompt requesting a passcode. Once the passcode is entered correctly, a System Start Up loading bar shall be visible. After the system has booted, the next page “HOME”, shall allow for the selection of auto mode, manual mode, media controls, and system shutdown.

3. The “AUTO MODE” page shall include a system mute button, master output volume control fader with buttons to allow the user to navigate back to the home page or a system shutdown page.

4. The “MANUAL MODE” page shall include a system mute button, channel fader volume controls, preamp controls and mutes for all available inputs with buttons to allow the user to navigate back to the home page or system shutdown page.

5. The “MEDIA CONTROLS” page shall provide transport controls for the CD player and Bluetooth reciever.

6. When system shutdown is selected, a prompt shall appear with the text “PLEASE CONFIRM SHUTDOWN”. The user will then select a button labeled “Yes” or “No”. If no is selected, the “HOME” page shall appear. If yes is selected, a system shutdown loading bar shall appear and all system inputs/outputs shall be muted and all associated amplifiers put in standby mode. Once the system shutdown sequence is complete, the “SYSTEM START UP” page shall be visible.

C. AUDIO AMPLIFERS

1. 2 qty. QSC CX-Q 8K4
   Program amplifier's DSP with data acquired during system tuning.
   Program each output channel with appropriate DSP settings to protect the speaker drivers from being over-driven and damaged.
2. 1 qty. QSC CX-Q 4K4
   Program amplifier's DSP with data acquired during system tuning.
   Program each output channel with appropriate DSP settings to protect the speaker drivers from being over-driven and damaged.
   a. Program each amplifier's DSP with data acquired during system tuning.
   a. Program each output channel with appropriate DSP settings to protect the speaker drivers from being over-driven and damaged.

D. WIRELESS MICROPHONES

1. 1 qty. Shure ULXD4Q-G50, QUAD channel digital wireless microphone receiver.
2. 4 qty. Shure ULXD2SM58-G50, wireless microphone handheld transmitter.
3. 4 qty. Shure ULXD1-G50, wireless microphone bodypack transmitter.
4. 4 qty. Shure SBC200, 2 bay charging station for wireless microphone transmitters.
5. 8 qty. Shure SB900B, rechargeable wireless microphone batteries.
6. 4 qty. Shure WA661, Mute Switch for wireless microphone bodypack transmitter.
7. 4 qty. Shure SM31FH, Fitness headset condenser microphone.
8. 1 qty. RF Venue DFINW, diversity remote antenna, white.
   a. Orient to achieve maximum coverage of Gymnasium.
   b. Provide Wire Guard to protect antenna from damage.
   c. Provide 1 qty. AtlasIED GN-13E. Reinforce device to ensure antenna is aimed properly.
   d. Provide 1 qty. Atlas Sound AD-12BE flange.

E. WIRED MICROPHONES

1. 4 qty. Shure SM58S.
2. 4 qty. K & M 26045-500-55 stackable mic stand.
3. 4 qty. K & M 211/2 mic stand boom arm.
4. 4 qty. Whirlwind MK425 XLR cable.

F. POWER DISTRIBUTION

1. 1 qty. Middle Atlantic PD-920R-SP, Rackmount Power, 9 Outlet, 20A with Series Surge Protection.
1. 1 qty. Middle Atlantic UPS-2200R, Rackmount Uninterruptible Power Supply 1650W.

G. LOCAL SOUND EQUIPMENT RACK

1. 1 qty. Middle Atlantic DWR 24-22PD.
   i. Move rack rails back 2" to allow the front door to close with devices installed.
2. 1 qty. Middle Atlantic VFD-24.
3. 1 qty. Middle Atlantic TD2LK – 2RU locking drawer.
   i. 1 qty. Middle Atlantic FI-2
4. 2 qty. Middle Atlantic RSH – Single RU Shelf
5. 1 qty. Middle Atlantic DWR-FK22 - fan kit.
6. Provide 5 extra front door keys to the Owner.
7. Populate all unused rack spaces with blank panels.
8. Install all rack mounted equipment with Middle Atlantic HTX, T20 Star Post,10-32 security-screws.

9. Building network devices shall be installed in the top spaces of the rack. Coordinate with Structured Cabling Contractor.

H. MEDIA PLAYER

1. 1 qty. Denon DN-700CB.

I. LOCAL SOUND SYSTEM SPEAKERS

1. 8 qty. QSC PL-DC12, WHITE.
    a. Terminate speakers in full range setting.
    b. Horizontal orientation.
    c. Aim speakers for evenly distributed and complete coverage of seating area.
2. 8 qty. QSC PL-DC12-YM, horizontal yoke mount, WHITE.
3. 2 qty. QSC PL-SUB15, WHITE.
4. Securely attach all speakers to building structure at a 5:1 safety factor.
    a. Contractor shall employ rigging attachment hardware rated SAE Grade 5 minimum.
    b. Attach 1 qty. safety cable to each speaker.
    c. Paint all rigging hardware to match ceiling color. Coordinate with Architect for paint manufacturer and code.

J. ASSISTED LISTENING SYSTEM

1. Provide (1) Listen Technologies LP 3CV 072 Assisted Listening System
    a. Provide (1) LA-124 antenna. Install at locations shown on drawings.
    b. Provide enough LR-200-072 Receivers to meet TAS and ADA standards as required by law.
    c. Provide with each additional LR-200-072 Receiver:
        i. 1 qty. LA-161 Ear Speaker.
        ii. 1 qty. LA-361 AA batteries.
        iii. 1 qty. LA-430 Earphone/Neck Loop Lanyard per four receivers.
    d. 8 qty. LA-361 AA batteries
    e. Coordinate with Architect for installation location of each LA-304 Signage Kit.

K. PLATES AND PANELS

1. All custom wall plates shall be manufactured by ProCo, RCI or Whirlwind.
    a. Anodized aluminum, BLACK with white lettering in 1/8” Sans Serif font.

L. OUTLETS / PLATES

1. ANTENNA PLATE, “W”.
    a. ProCo 2 gang anodized plate, black with 2 qty 50 Ohm BNC connectors and 1 qty. Atlas Sound AD-12BE.
    b. 1 qty. Atlas Sound GN-13E.
        i. Reinforce to maintain antenna aiming orientation.
    c. Quantity and locations as shown on drawings.
    d. Provide wire guard to protect from flying objects.
2. ASSISTED LISTENING ANTENNA PLATE, “H”.
    a. ProCo single gang antenna plate with 1 qty. 50 Ohm BNC connector.
    b. Quantity and locations as shown on drawings.
    c. Provide wire guard to protect from flying objects.

M. INTERCOM INTERFACE

1. 1 qty. RDL TX-70A Speaker Level Input Interface.
    a. Local Sound Contractor to provide and install necessary cabling to connect to Intercom system.
    b. Connect to Audio DSP. Duck Local Sound System during announcements and use local sound speakers to reinforce Intercom System.
    c. Coordinate with Building Intercom Contractor for integration of systems

N. ASSISTED LISTENING SYSTEM

1. 1 qty. LS-54-216 Assisted Listening System
2. 1 qty. LA-124 antenna. Install at locations shown on drawings.
3. Provide enough LR-4200-216 Receivers to meet TAS and ADA standards as required by law.
4. Provide with each additional LR-4200-216 Receiver:
    a. 1 qty. LA-401 Ear Speaker.
    b. 1 qty. LA-430 Earphone/Neck Loop Lanyard
5. Coordinate with Architect for installation location of each LA-304 Signage Kit.

2.2 CAFETERIA

A. EQUIPMENT RACK & ACCESSORIES

1. 1 qty. Middle Atlantic DWR 24-22PD.
    a. Move rack rails back 2” to allow the front door to close with devices installed.
2. 1 qty. Middle Atlantic VFD-24.
3. 1 qty. Middle Atlantic TD2LK – 2RU locking drawer.
    a. 1 qty. Middle Atlantic FI-2
4. 2 qty. Middle Atlantic RSH – Single RU Shelf
1. 1 qty. Middle Atlantic DWR-FK22 - fan kit.
2. Provide 5 extra front door keys to the Owner.
3. Populate all unused rack spaces with blank panels.
4. Install all rack mounted equipment with Middle Atlantic HTX, T20 Star Post,10-32 security-screws.
5. Building network devices shall be installed in the top spaces of the rack. Coordinate with Structured Cabling Contractor.
6. Installed in Chair Storage F103A.

B. WIRELESS MICROPHONES

1. 1 qty. Shure ULXD4D-G50, DUALchannel digital wireless microphone receiver.
    a. Install in associated AV rack.
2. 2 qty. Shure ULXD2SM58-G50, wireless microphone handheld transmitter.
3. 2 qty. Shure ULXD1-G50, wireless microphone bodypack transmitter.
4. 2 qty. Shure SBC200, 2 bay charging station for wireless microphone transmitters.
5. 4 qty. Shure SB900B, rechargeable wireless microphone batteries.
6. 2 qty. Shure WA661, Mute Switch for wireless microphone bodypack transmitter.
7. 2 qty. Shure SM31FH, Fitness headset condenser microphone.
8. 1 qty. RF Venue DFINW, diversity remote antenna, white.
    a. Orient to achieve maximum coverage of Gymnasium.
    b. Provide Wire Guard to protect antenna from damage.
    c. Provide 1 qty. AtlasIED GN-13E. Reinforce device to ensure antenna is aimed properly.

d. Provide 1 qty. Atlas Sound AD-12BE flange.

C. AMPLIFIERS

1. 1 qty. QSC CX-Q 4K4.
   a. Install in associated AV rack.
2. Program amplifier's DSP with data acquired during system tuning. Program each output channel with appropriate DSP settings to protect the speaker drivers from being over-driven and damaged.
   a. Program each amplifier's DSP with data acquired during system tuning.
3. Program each output channel with appropriate DSP settings to protect the speaker drivers from being over-driven and damaged.

D. NETWORK DEVICES AND CONTROL

1. 1 qty. QSC TSC-70-G3 – Touch screen controller panel UCI – "TSC'.
   a. 1 qty. Honeywell CG512A1009 Large Thermostat Guard
   b. Provide 5 sets of keys
   c. Install in local sound rack.
2. 1 qty. WALL PLATE AUDIO - "WPA". QSC UNDX2IO+, Two (2) mic/line inputs, two (2) line outputs.
      i. ProCo double gang decora wall plate cover.
      ii. Label plate Inputs "MIC 1 – MIC #".
   c. Label plate Outputs "OUT 1 – OUT #".
   d. Cover up manufacturers factory IN/OUT labels.
   e. Install plates, ascending in mic # from low to high from house left to house right.
   f. Quantity and locations as shown on drawings.
3. 1 qty. BT WALL PLATE, - "BT".
   a. QSC UND610-BT – dante, bluetooth receiver with dual microphone, dual rca, 1/8" aux in and outputs.
   b. Cover up manufacturers factory IN/OUT labels.
      1. Install plates, ascending in mic # from low to high from house left to house right.
   d. Quantity as shown on drawings.
4. Provide all cables required to connect all devices for a fully functional system.
5. 1 qty. Netgear M4250-26G4F-PoE++ (GSM4230UP), 24x1G PoE++ 1,440W 2x1G and 4xSFP Managed Switch.
6. 4 qty. Netgear AGM731F, SFP Transceiver 1000BASE-SX module.
7. 1 qty. ComScope 760162800 | UNP-6A-DM-1U-24, 24 Port Cat6a Patch Panel

E. CD PLAYER

1. 1 qty. Denon DN-700CB.

F. CEILING SPEAKERS

1. 19 qty. QSC AD-C821 ceiling speaker, tap at 100 watts.

G. GRAPHICAL USER INTERFACE / TOUCH PANELS

1. Program QSC Audio System and UCI to allow for control of complete audio matrix routing, input selection, audio level control and mute for each audio input and other such controls as directed by the Owner. Coordinate with Owner and Consultant for final GUI functionality and layout. Coordinate with Owner for Logo to be displayed on

splash screen. Provide a numeric (0-9) password page immediately after the splash page. Provide a simple way for Owner to change and store new password from the GUI with a press-and-hold hidden button to access password change page.

2. The first page “SYSTEM START UP” shall have the text, “PRESS ANYWHERE TO START SYSTEM”. The next page shall display a prompt requesting a passcode. Once the passcode is entered correctly, a System Start Up loading bar shall be visible. After the system has booted, the next page “HOME”, shall allow for the selection of auto mode, manual mode, media controls, and system shutdown.

3. The “AUTO MODE” page shall include a system mute button, master output volume control fader with buttons to allow the user to navigate back to the home page or a system shutdown page.

4. The “MANUAL MODE” page shall include a system mute button, channel fader volume controls, preamp controls and mutes for all available inputs with buttons to allow the user to navigate back to the home page or system shutdown page.

5. The “MEDIA CONTROLS” page shall provide transport controls for the CD player and Bluetooth reciever.

6. When system shutdown is selected, a prompt shall appear with the text “PLEASE CONFIRM SHUTDOWN”. The user will then select a button labeled “Yes” or “No”. If no is selected, the “HOME” page shall appear. If yes is selected, a system shutdown loading bar shall appear and all system inputs/outputs shall be muted and all associated amplifiers put in standby mode. Once the system shutdown sequence is complete, the “SYSTEM START UP” page shall be visible.

H. INTERCOM INTERFACE

1. 1 qty. RDL TX-70A Speaker Level Input Interface.
    a. Local Sound Contractor to provide and install necessary cabling to connect to Intercom system.
    b. Connect to Audio DSP. Duck Local Sound System during announcements and use local sound speakers to reinforce Intercom System.
    c. Coordinate with Building Intercom Contractor for integration of systems

I. ASSISTED LISTENING SYSTEM

1. 1 qty. LS-54-216 Assisted Listening System
2. 1 qty. LA-124 antenna. Install at locations shown on drawings.
3. Provide enough LR-4200-216 Receivers to meet TAS and ADA standards as required by law.
4. Provide with each additional LR-4200-216 Receiver:
    a. 1 qty. LA-401 Ear Speaker.
    b. 1 qty. LA-430 Earphone/Neck Loop Lanyard
5. Provide 1 qty. LA-124 antenna.
6. Coordinate with Architect for installation location of each LA-304 Signage Kit.

J. PLATES AND PANELS

1. All custom wall plates shall be manufactured by ProCo, RCI or Whirlwind.
    a. Anodized aluminum, BLACK with white lettering in 1/8” Sans Serif font.

K. OUTLETS / PLATES

1. ANTENNA PLATE, “W”.
    a. ProCo single gang anodized plate, black with 1 qty 50 Ohm BNC connectors and
    b. Quantity and locations as shown on drawings.
2. ASSISTED LISTENING ANTENNA PLATE, “H”.
    a. ProCo single gang antenna plate with 1 qty. 50 Ohm BNC connector.
    b. Quantity and locations as shown on drawings.

L . PROJECTION SCREEN

1. 1 qty. DaLite Tensioned Contour Electrol SKU# 70186L.
    a. 189” Diagonal Screen. 16:10 Aspect Ratio. Black housing. Dual-Vision – DA-TEX, rear projection screen material.
    b. Suspend from building structure behind front curtain teaser.

M. VIDEO PROJECTOR

1. 1 qty. Epson V11HA35920, EB-PU1006W – WUXGA, 6,000 lumens projector
    a. With Epson #V12H004M0F, ELPLW06 lens
    b. Verfiy proper focal length prior to installation
    c. Provide all required mounting hardware and adapters
        i. Manufacturer: Chief MFG

2.3 BAND HALL, AUXILIARY MUSIC, ORCHESTRA, CHOIR. (TYPICAL OF FOUR SYSTEMS).

A. AV NETWORK PERIPHIALS AND I/O

1. 1 qty. QSC TSC-101-G3 – Touch screen controller panel UCI - “TSC”.
2. 1 qty. WALL PLATE AUDIO - “WPA”.
    a. QSC UNDX2IO+, Two (2) mic/line inputs, two (2) line outputs.
        i. ProCo double gang decora wall plate cover.
    a. Label plate Inputs “MIC 1 – MIC 2”.
    b. Label plate Outputs “OUT 1 – OUT 2”.
    c. Cover up manufacturers factory IN/OUT labels.
    d. Install plates, ascending in mic # from low to high from house left to house right.
    e. Quantity and locations as shown on drawings.
3. BT WALL PLATE, “BT”.
    a. 1 qty. QSC UND610-BT – dante Bluetooth receiver with dual microphone, dual rca, 1/8” aux in and outputs.
    b. Quantity as shown on drawings.
4. 4 qty. QSC QIO-ML4i, Four (4) mic/line inputs audio expander.
    a. Inputs for recording mics in all performing arts rooms.
    b. Installed in IDF E114.
5. 2 qty. QSC QIO-L4o, Four (4) line output audio expander.
    a. Outputs to feed Listen Tech transmitters.
    b. Installed in IDF E114.

B. NETWORK MEDIA PLAYER/RECORDER

1. 1 qty. Denon DN900R - Network SD/USB Audio Recorder with Dante 2 x 2 Interface.

a. Installed in IDF E114.
b. Create custom UCI with transport controls.
C. End user shall be able to view and select tracks from recordings to playback from UCI.

2. 2 qty. SanDisk SDSDXXO-032G-ANCIN - 32GB Extreme PRO UHS-I SDHC Memory Card.

C. GRAPHICAL USER INTERFACE / TOUCH PANELS

1. Program QSC Audio System and UCI to allow for control of complete audio matrix routing, pre amp, input selection, audio level control and mute for each audio input and other such controls as directed by the Owner. Coordinate with Owner and Consultant for final UCI functionality and layout. Coordinate with Owner for Logo to be displayed on splash screen. Provide a numeric (0-9) password page immediately after the splash page. Provide a simple way for Owner to change and store new password from the GUI.

2. The first page “SYSTEM START UP” shall have the text, “PRESS ANYWHERE TO START SYSTEM”. The next page shall display a prompt requesting a passcode. Once the passcode is entered correctly, a System Start Up loading bar shall be visible. After the system has booted, the next page “HOME”, shall allow for the selection of auto mode, manual mode, media controls, and system shutdown.

3. The “AUTO MODE” page shall include a system mute button, master output volume control fader with buttons to allow the user to navigate back to the home page or a system shutdown page.

4. The “MANUAL MODE” page shall include a system mute button, channel fader volume controls, preamp controls and mutes for all available inputs with buttons to allow the user to navigate back to the home page or system shutdown page.

5. The “MEDIA CONTROLS” page shall provide transport controls for the Denon DN900R for recording and playback.

6. When system shutdown is selected, a prompt shall appear with the text “PLEASE CONFIRM SHUTDOWN”. The user will then select a button labeled “Yes” or “No”. If no is selected, the “HOME” page shall appear. If yes is selected, a system shutdown loading bar shall appear and all system inputs/outputs shall be muted and all associated amplifiers put in standby mode. Once the system shutdown sequence is complete, the “SYSTEM START UP” page shall be visible.

D. AUDIO AMPLIFIERS

1. 2 qty. QSC CX-Q 2K4
   a. Program amplifier’s DSP with data acquired during system tuning.
   b. Program each output channel with appropriate DSP settings to protect the speaker drivers from being over-driven and damaged.
   c. 1 qty. Amplifier for speakers in Band Hall D111 and Aux Music Room D113..
   d. 1 qty. Amplifier for speakers in Orchestra Room D105 and Choir Room D109.
   e. Install both amplifiers in IDF D107.

E. WIRED MICROPHONES

1. 2 qty. Shure SM58S.

2. 2 qty. K & M 26045-500-55 stackable mic stand.
3. 2 qty. K & M 211/2 mic stand boom arm.
4. 2 qty. Whirlwind MK425 XLR cable.

F. CEILING MICROPHONE

1. Shure VP88 – dual element condenser microphone.
    a. Ensure microphone is installed in appropriate orientation and safely secured.
    b. Quantities as shown on drawings.

G. LOCAL SOUND SYSTEM SPEAKERS

1. 2 qty. QSC AD-S12 Indoor/Outdoor speakers (Install and aim to maximize coverage of seating areas), white.

H. ASSISTED LISTENING SYSTEM

1. 1 qty. LS-54-216 Assisted Listening System
2. 1 qty. LA-124 antenna. Install at locations shown on drawings.
3. Provide enough LR-4200-216 Receivers to meet TAS and ADA standards as required by law.
4. Provide with each additional LR-4200-216 Receiver:
    c. 1 qty. LA-401 Ear Speaker.
    d. 1 qty. LA-430 Earphone/Neck Loop Lanyard
5. Coordinate with Architect for installation location of each LA-304 Signage Kit.
6. Install the LT-803-072-01 transmitters in IDF D107.

I. PLATES AND PANELS

1. All custom wall plates shall be manufactured by ProCo, RCI or Whirlwind.
    a. Anodized aluminum, BLACK with white lettering in 1/8” Sans Serif font.

J. OUTLETS / PLATES

1. ASSISTED LISTENING ANTENNA PLATE, “H”.
    a. ProCo single gang antenna plate with 1 qty. 50 Ohm BNC connector.
    b. Quantity and locations as shown on drawings.

K. POWER DISTRIBUTION

1. 1 qty. Middle Atlantic PD-920R-SP, Rackmount Power, 9 Outlet, 20A with Series Surge Protection. One for the single rack.
2. 1 qty. Middle Atlantic UPS-2200R, Rackmount Uninterruptible Power Supply 1650W. One for the single rack

L. LOCAL SOUND EQUIPMENT RACK (One rack for all four rooms) Installed in IDF D107.

1. 1 qty. Middle Atlantic DWR 35-26PD.
    i. Move rack rails back 2” to allow the front door to close with devices installed.
2. 1 qty. Middle Atlantic VFD-35
3. 1 qty. Middle Atlantic TD2LK – 2RU locking drawer.
    i. 1 qty. Middle Atlantic FI-2
4. 2 qty. Middle Atlantic RSH – Single RU Shelf
5. 1 qty. Middle Atlantic UQFP-4RT.

6. Provide 5 extra front door keys to the Owner.
7. Populate all unused rack spaces with blank panels.
8. Install all rack mounted equipment with Middle Atlantic HTX, T20 Star Post,10-32 security-screws.

2.4 LIBRARY A127

A. CONTROL

1. 1 qty. QSC TSC-50-G3 – Touch screen controller panel UCI for power control and HDMI source selection of smart board display. Volume control of local sound speakers.
    a. Coordinate with district IT for Vlan assignment and connectivity to Qsys Core 610.

2. 1 qty. Global Cache IP2SL iTach Serial Converter.
    a. Coordinate with district IT for Vlan assignment and connectivity to Qsys Core 610.

B. AUDIO AMPLIFIERS

1. 1 qty. QSC SPA-QF 60X4
    a. Installed behind display. Provide necessary mounting hardware.
    b. Program amplifier's DSP with data acquired during system tuning.
    c. Program each output channel with appropriate DSP settings to protect the speaker drivers from being over-driven and damaged.
    d. Configure outputs for Hi Impedance 70v bridged.
    e. Use the Flex channel(s) (Inputs) for video audio from display.

C. LOCAL SOUND SYSTEM LOUDSPEAKERS

1. 2 qty. QSC AD-S10T, white.
    a. Tap speakers at 50 watts.

2.5 AV NETWORK HEAD END – IDF D107

A. AV CONTROL AND PROCESSING SYSTEM

1. Coordinate with Owner's IT personnel to create a VLAN on the building network for the AV systems.
2. 2 qty. QSC Core 8 Flex Processor.
    a. Configured for redundancy.
    b. Lan A for Qlan/Dante, Lan B for internet access.
    c. Coordinate with District IT department to provide internet access and AV VLAN.
3. 2 qty. QSC QIO-24F, Eight (8) mic/line level inputs, eight (8) software-definable Flex channels and eight (8) line level outputs
4. 1 qty. QSC QIO-CK redundancy cable kit
5. Partition Sensor to audio combine/uncombine Cafeteria and gym system. Legrand Partition Sensor

B. AUDIO VIDEO NETWORK

1. 1 qty. Netgear M4250-40G8XF-PoE+ (GSM4248PX), 40x1G PoE+ 960W and 8xSFP+ Managed Switch.
2. 1 qty. ComScope 760162800 | UNP-6A-DM-1U-24, 24 Port Cat6a Patch Panel.
3. LAG network on fiber ports between AV switches in GYN STORE F110C and STAGE D108 rack.

B. EQUIPMENT RACK AND ACCESSORIES

1. 1 qty. Middle Atlantic SR28-46-32, Wide SR Series Large Pivoting Rack.
2. 1 qty. Middle Atlantic VFD-46, 46 RU Vented Front Door for SR Racks.
3. 1 qty. Middle Atlantic DWRSR-138FT-K-EU, 138 CFM Fan Kit for SR and DWR Racks.
4. 2 qty. Middle Atlantic PD-920R-SP, Rackmount Power, 9 Outlet, 20A with Series Surge Protection.
5. 2 qty. Middle Atlantic UPS-2200R, Rackmount Uninterruptible Power Supply 1650W.
6. 1 qty. Middle Atlantic Products SS, 1RU Heavy duty sliding shelf.

C. AV SYSTEM SCHEDULING

1. Contractor shall program the QSYS control system to automatically shut down system every day at midnight 12am CST and recall a default configuration. This includes muting audio source inputs and setting to default level (ceiling mic inputs should always be unmuted and set at nominal level), putting all amplifiers in standby, projectors lamped off, lifts, shades and projector screens raised, video walls and displays put into standby.

D. AV SYSTEM ADMINISTRATOR MONITORING AND CONTROL

1. The contractor shall program a password protected UCI for the district systems administrator to access from a district computer with QSYS UCI Viewer.
2. This UCI shall provide all system diagnostics including but not limited to, system wide device health, network audio metering, ptz camera feeds, network video streams per room, display, projector and projector lift status; with the ability to control each rooms UCI remotely, per campus.
3. The contractor shall provide the district with QSYS Reflect Enterprise Manager professional tier services during the warranty period for all systems and peripherals.

2.6 FIRE ALARM OVERRIDE

A. Provide for Fire Alarm Override for each Local Sound system. Contractor shall provide all cabling, relays, mounting hardware and any other devices (Fire Alarm System devices by others) to provide a fully functioning Fire Alarm Override system. When Fire Alarm is active, each Local Sound System shall be muted. When Fire Alarm ceases, each Local Sound System shall automatically revert to normal operation.

2.7 SCHOOL INTERCOM PUBLIC ADDRESS OVERRIDE

A. Provide for School Intercom Public Address Override for each Local Sound System. Contractor shall provide and install (1) RDL TX-70A, 70v to Line level converter. Contractor shall provide, install and terminate cabling to nearest School Intercom speaker and shall integrate devices into local sound system. Provide DSP programming to duck Local Sound System to give priority to the School Intercom PA System. Coordinate with Building Intercom Contractor for integration of systems

2.8 CABLE ROUTING/PATHWAY

A. Cable Support System: All audio-video cabling shall be installed and supported using a cable support system at 4’-0” intervals unless installed in conduit. Do not exceed manufacture recommendation for the quantity of cables supported in an individual support.

B. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

2.9 AUDIO-VIDEO SYSTEM WIRING AND TERMINATING HARDWARE

A. Cabling:

1. Provide a complete audio/video cabling solution from back of eah faceplate to device I/O locations as designated on the contract drawings. Each cable provided shall be installed with a minimum of 10’ of excess slack above each outlet location. Contractor shall properly support and label all cabling at each outlet.

2. Contractor shall ensure all cabling requirements are met to provide fully functional A/V systems, specified cabling notwithstanding.

PART 3 – EXECUTION

3.1 WIRING AND INSTALLATION TECHNIQUES

A. Coordinate all work with all other trades to avoid causing delays in construction schedule. Contractor shall expedite the delivery of materials and provide additional labor as required to meet construction deadline.

B. Coordinate final connection of power and ground wiring to equipment racks by electrical contractor. Power and ground wiring shall terminate inside equipment racks on standard duplex outlets. Mount as to not interfere with internal equipment of the rack. Power shall be a dedicated circuit and not share with any other source. Ground per NEC with third wire (green) to panel ground lug at breaker supply panel.

C. All equipment and enclosures described in this specification section shall be plumb and square. All equipment except portable equipment shall be permanently attached to the structure and held firmly in place. Supports shall be adequate to support their loads with a safety factor of at least five.

D. Wiring and installation under this contract to meet NFPA, NEC, and local code requirements where applicable.

E. The process of equalizing and testing the Audio Sound System may necessitate moving and adjusting certain component parts (e.g., loudspeakers). This shall be done without claim for additional payment.

F. Take such precautions as are necessary to prevent and guard against electromagnetic and electrostatic hum. Separate all low level microphone and auxiliary inputs from speaker output conductors, data or other system wiring.

G. All wiring shall be labeled using vinyl wire labeling tags. Use Brady^{tm} model BMP21 or equal wire labeling printer. Label input, output and wireless wiring. Label electrical power beaker at electrical panel. Label location of room and power panel/breaker at equipment rack. Protect labels with clear heat shrink.

H. Label all mixer inputs with their respective input. Example: mixer input 1 – “Mic-1”, etc. Label to reflect name on engraved wall plate.

I. Solder all microphone connections using rosin core solder. Use temperature controlled soldering equipment. Microphone XLR connectors shall use standard wiring code as follows: pin 1 shield/ground, pin 2 positive, pin 3 negative.

J. Paint all back boxes and conduit prior to installation of wiring or connectors. Protect and do not paint any wiring or equipment rack cabinets.

K. Install equipment cabinet in a controlled temperature, dry and accessible area. Provide sufficient space to completely open the front and rear of the cabinet. Equipment not to be in general gym area where it can be damaged.

3.2 CABLING

A. General: Unless otherwise noted, provide the following cable types (or equivalent) for each application:

1. West Penn 454 #22 AWG twisted pair / shielded for Microphone and Line level signals.
2. West Penn C210 #10 AWG twisted pair for subwoofer / low frequency speakers.
3. West Penn 227 #12 AWG twisted pair for conventional, full range sound reinforcement speakers.
4. West Penn 226 #14 AWG twisted pair for 70v sound reinforcement speakers.
5. West Penn 810 RG-8 coax cable for analog RF signal lines.
6. West Penn 4246 CAT6 cable for Local Sound/Video Network and Dante digital audio devices.
7. West Penn 4246F F/UTP CAT6 for digital audio snake devices.
8. West Penn 4246AF F/UTP CAT6A cable for HDBaseT video devices.
9. Crestron CRESNET.
10. Corning 006TSP-T4180D20 multi-mode fiber optic cable for drop face plate connections.
    a. Provide Corning 95-050-99-X LC fiber connectors for multimode terminations.
11. Corning 006ESP-T4101D20 single-mode fiber optic cable for network switch interconnections.
    a. Provide Corning 95-200-99 LC fiber connectors for single mode terminations.
12. Provide plenum rated cable where required.

3.3 INSPECTIONS

A. General: Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/ Designer may inspect before acceptance.

B. Ensure all systems are installed to provide uniform, balanced audio coverage throughout each intended listening area. Ensure there are no rattles, buzzes, hums, RF interference, electro-static interference, feedback or other audible audio anomalies while the systems are in operation.

C. Contractor shall use white / pink noise generator and audio spectrum analyzer to set overall frequency response and equalization. Ensure gain structure is properly set to prevent clipping on any device and to provide balanced system functionality. Provide proper limiter programming to prevent damage to all audio components. District Maintenance personnel to be on site during process.

D. Demonstrate the performance of each system and give instructions of proper operation and maintenance to the Owner. Provide a minimum of eight hours of training and basic system operating instructions for each system in not more than four hour sessions. Include a list of system training attendees in the Close-Out Documentation.

1. Contactor shall record each training session with a 720p, miminum, digital video recording device, with audible audio, in .MOV or .MP4 format and compile sessions

onto 128MB thumb drives (as many as required) (SanDisk, Kingston or PNY) and provide to Owner. Contractor shall title each video file with the room name of the system and date; e.g., “Dining Commons – August 15, 2019.”

2. Contractor shall provide an asbuilt QSYS designer file, Dante Controller preset, Shure wireless work bench inventory/RF coordination report and Netgear switch master configuration file supplied on a usb flash drive. In the event when systems are updated during service calls during the warranty period, the contractor shall furnish updated system files to the district.

END OF SECTION

SECTION 27 51 23.90 – RESCUE ASSISTANCE SIGNAL SYSTEM - AUDIO/VISUAL (AREA OF REFUGE)

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. Furnish, install, and wire all equipment associated with the installation of an Audio-Visual Rescue Assistance Signal System (Area of Refuge) to comply with ADA and NFPA requirements. This work shall include a main annunciator panel, remote call stations, power supply, outlet boxes, cables and wiring as shown on the drawings and as specified herein.

1.2 SUBMITTALS

A. Showing typical field wiring connections as well as single line floor plan indicating equipment locations as well as cable routings and quantities.

B. Product Data: Submit product data, including manufacturer's (Spec-Data) product sheet, for specified products.

C. Shop Drawings: Shop drawings shall indicate locations of all system components and required voltage requirements of main control unit.

1.3 INSTALLATION STANDARDS

A. The system shall be installed in accordance with the 2008 NEC, NFPA and ADA requirements.

B. The completed system shall be in compliance with state and local electrical codes.

C. All wiring shall test free from grounds and shorts.

1.4 SYSTEM OPERATIONS

A. Furnish, install and place into operation a Rescue Assistance System for this building as indicated on the drawings and as specified herein.

B. A common annunciator shall be provided in the first floor reception office to indicate light and tone signals from multiple remote call stations.

1. When the call station switch is activated, a red LED button illuminates and a one shot tone sounds.
2. When the alarm signal is acknowledged, the remote call station is signaled with a flashing light and tone.
3. Voice communication with the remote call can then be initiated from the annunciator.
4. Provide for off-site calling to the monitoring station per Harris County Fire Marshal Office (HCFMO).

PART 2 - PRODUCTS

2.1 RESCUE ASSISTANCE-VISUAL EQUIPMENT

A. Manufacturer: Cornell Communications, Inc.

2.2 COMPONETS

A. Equipment

1. This system shall consist of multiple remote call stations, which will share a common annunciator panel and optional access to a public telephone system for external alarm notification.

B. Annunciator (Control Station)

1. The annunciator panel shall be a CORNELL Model A4232/36, surface mounted at a normally attended area of the facility.
2. An alternate action switch with internal LED indicator shall be included for each zone.
   a. A yellow LED light on the zone switch shall illuminate and the alarm shall emit a repeating sound if the supervised wiring is faulted.
3. An audible alarm shall be mounted on the annunciator panel, which will emit a minimum sound level of 90 db at 30 cm when a remote station calls.
   a. Depressing the zone switch will answer a zone and open the intercom line to the zone.
4. The front panel shall have silk-screened zone designations and operating directions as well as zone designation strips.
5. The power supply shall be a 120 volt emergency battery backup, CORNELL model B-5243A or P-512243A.
6. Provide Cornell BB-45 back box.

C. Remote Call Stations

1. The Vandal Proof Call Station shall be Cornell Model 4201/V. The standard two gang mounting plate cm be flush mounted or wall mounted and incorporate heavy duty switches and speakers along with stainless steel plates and tamper-proof screw. The 4201/V shall contain water resistant switch and speaker for exterior applications.
2. The station shall have hands free voice communication with the annunciator.
3. The station shall have silk-screened operating instructions.
4. The station shall be flush wall mounted on a 2-gang stainless steel plate with a 42" maximum mounting height for forward reach, and a 54” maximum for side reach.

D. Rescue Assistance Signage

1. Where exit signage illumination is required at the area of rescue assistance stairwells, the installing contractor shall provide the Cornell Model SN-E42S, 120Vac lighted sign outside of each stairwell with rescue assistance. The sign shall be provided by this contractor and powered and installed by the electrical contractor. Also provide a Cornell Model SN-P42F 6" x 16", white PVC plastic with blue lettering sign inside of each stairwell with rescue assistance.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.2 INSTALLATION

A. Cabling Requirements

1. Wiring from the annunciator to the call station shall be 22-gauge, 2 conductor

shielded audio pair + 4 conductor unshielded.

2. Wiring from the annunciator to the power supply shall be 18-gauge, 2 conductor.
3. Verify cable types with the Rescue Assistance System Manufacturer.

3.3 FIELD QUALITY REQUIREMENTS

A. Site Tests (Post Installation Testing): Checkout final connections to the system shall be made by a factory technician authorized by the manufacturer of the products installed.

1. Factory authorized technicians shall demonstrate operation of the complete system and each major component to the staff.
2. System field wiring diagrams shall be provided to this subcontractor by the system prior to installation.

B. Inspection: Perform a complete functional test of the system upon completion of the installation and instruct the staff in the operation and maintenance of the system.

END OF SECTION

SECTION 28 05 00 - GENERAL ELECTRONIC SAFETY SYSTEMS REQUIREMENTS

PART 1 – GENERAL

1.1 WORK INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Furnishing of all required materials, equipment, tools, scaffolding, labor, and transportation necessary for the complete installation of the Electronic Safety Systems as shown on the drawings and as specified herein.

C. Coordinate wireway, raceway, power, and outlet requirements with the builder and the electrical contractor.

D. Cable pathways, conduit, boxes and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

E. The Electronic Safety Systems Contractor shall provide and install prior to cable installation plastic snap in bushings at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves to protect the cabling from damage.

F. Supply in a timely manner to the electrical contractor special backboxes for installation as required.

G. It is the intent of these specifications to provide complete installations although every item necessary may not be specifically mentioned or shown.

1.2 WORK TO BE INCLUDED BY THE ELECTRICAL CONTRACTOR IN BASE CONTRACT PROPOSAL

A. Provide utility services conduit as outlined on drawings as required.

B. All required conduit for accessibility to attic space.

C. Furnishing and installation of all required standard back boxes and conduit.

D. Installation of special back boxes supplied by Division 28 contractor(s).

E. Furnishing and installation of all floor boxes, surface raceways, and other wireways which are detailed or specified under Division 26.

F. Provide equipment-mounting boards as outlined on drawings.

G. Provide equipment grounding system, conductors, and bus bars and as outlined in Division 26.

H. Provide 120-volt power and hook-up to equipment provided in Division 28.

I. Coordination of requirements of Division 28 with the Builder.

1.3 WORK NOT INCLUDED

A. Contractors shall make no agreement that obligates the Owner to pay any company providing communications, monitoring, or other services. Contractors shall not make selection,

purchase, or installation of interconnect instruments/equipment to be used on this project.

1.4 RELATED SECTIONS

A. The conditions of the Division 0, Division 1, Division 26 requirements, and the contract requirements that include the General Conditions and the Supplementary Conditions apply to work of this division.

B. Section 26 05 34 - Provisions For Communication, Security & Safety Systems.

1.5 CODES, STANDARDS, AND THEIR ABBREVIATIONS

A. General:
   1. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.
   2. In addition to the requirements outlined in other sections of the specifications the following standards are imposed as applicable to the work in each instance:
      a. OSHA Safety and Health Regulations for Construction.
      b. NFPA No. 70 National Electrical Code.
      c. NESC National Electrical Safety Code, ANSI Standard C2.
      d. NEiS National Electrical Installation Standards.
      e. Local Codes and Ordinances.

B. Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof. Any such additional work shall be performed at no additional cost to the Owner.

C. Materials and components shall be UL listed and labeled by Underwriters Laboratories, Inc. for the intended use under the latest appropriate testing standard.

D. The Contractor shall obtain all permits required to commence work. Upon completion of the Work, the Contractor shall obtain and deliver to the Owner's Representative a Certificate of Inspection and Approval from the State Board of Fire Underwriters and other authorities having jurisdiction. The Contractor shall pay required permit fees.

1.6 LIST OF ASSOCIATIONS AND STANDARDS:

ADA: Americans with Disabilities Act.
ANSI: American National Standards Institute, 1430 Broadway; New York, NY 10018.
ASTM: American Society for Testing and Materials, 1916 Race Street; Philadelphia, PA 19103.
BICSI: (RCDD5 Standards), 8610 Hidden River Parkway, Tampa, FL 33637
CBM: Certified Ballast Manufacturers Association, 2116 Keith Building; Cleveland, Ohio 44115.
IEEE: Institute of Electrical and Electronics Engineers, 345 East 47th Street; New York, NY 10017.
ICEA: Insulated Cable Engineers Association, P.O. Box P, South Yarmouth, MA 02664.
NEC: National Electrical Code; NFPA No. 70.
NECA: National Electrical Contractors Association, Inc., 7315 Wisconsin Ave.; Washington, DC 20014.
NEMA: National Electrical Manufacturers Association, 155 East 44th Street; New York, NY 10017.
NESC: National Electrical Safety Code, ANSI Standard C2.
NFPA: National Fire Protection Association, 60 Batterymarch Street; Boston, MA

02110.
OSHA: Occupational Safety and Health Administration, US Department of Labor; Washington, DC 20402.
TAS: Texas Accessibility Standards (TAS) Article 9102.
UL: Underwriters Laboratories, Inc., 333 Pfigsten Road; Northbrook, IL 60062.

A. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.

B. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.

C. The date of the code or standard is that in effect on the date of issue stated on the contract documents, except when a particular publication date is specified.

D. The Contractor shall comply with all State, Federal, NFPA, local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

E. Where local codes and ordinances are not in writing or on record but local precedence have been set, the Owner shall pay for any additional resulting cost.

1.7 DEFINITIONS

A. Approval: It is understood that approval must be obtained from the Architect in writing before proceeding with the proposed work. Approval by the Architect of any changes, submitted by the Contractor, will be considered as general only to aid the Contractor in expediting his work.

B. The Builder: The primary contractor engaged to oversee the construction project. They may be technically described as a Construction Manager, General Contractor, Managing Construction Contractor, et cetera.

C. The Contractor: The Contractor engaged to execute the work included a particular section only, although he may be technically described as a Subcontractor to the Builder. If the Contractor, engaged to execute said work, employs Sub-Contractors to perform various portions of the work included under a particular Section, they shall be held responsible for the execution of this work, in full conformity with Contract Document requirements. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various sections and phases of work may be properly coordinated without unnecessary delays or damage.

D. The Electrical Contractor: The Electrical Contractor shall be engaged to execute the work included Division 26 only.

E. PDF file or .pdf: The filename extension associated with “Portable Document Format” files, which are multi-platform computer files in the ISO 32000-1:2008 open standard format developed and licensed by Adobe Systems. These files are a digital electronic representation of text, documents, images, and technical drawings in a font and color-accurate fixed-layout format that is platform and display resolution independent. PDF files can be electronically transmitted, viewed, or printed with various free PDF reader application programs, and may allow markups/comments with various PDF editing application programs.

F. Provide: Defined as requiring both the furnishing and installation of the item or facility indicated, complete in all respects and ready for operation unless otherwise specifically noted.

1.8 SCHEDULE OF VALUES, APPLICATION FOR PAYMENT

A. The Contractor shall in accordance with the General Provisions of the Contract, including

General and Supplementary Conditions, and Division 1, complete a Schedule of Values and Applications for Payment. When a portion of this work separately funded, including donations or E-Rate, the contractor shall accommodate this in the Schedule of Values and Applications for Payment. For E-Rate eligible portions of this work, the contractor will be required to participate in the E-Rate program, comply with all E-Rate regulations, and provide billing as needed. The contractor shall coordinate with the Owner to file Form 471 or latter edition and/or other forms as may be required.

1.9 WARRANTY

A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from date of acceptance of the job.

B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.

C. He shall remedy any defects due thereto, and pay for any damage to other work resulting there from, which shall appear within a period of one year from date of substantial completion.

D. The Owner shall give notice of observed defects with reasonable promptness.

E. This Warranty shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.10 SITE VISIT

A. Before submitting a proposal, each proposed contractor shall examine all plans and specifications relating to the work, shall visit the site of the project, and become fully informed of the extent and character of the work required, including all required utilities.

B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.11 SUBMITTALS

A. Submittal procedures shall be per Division 1 - General Requirements.

B. Provide a complete submittal for each section as specified.

C. Submit complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

D. A submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

E. Each Product data submittal shall include:
   1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
   2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.

3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
4. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
6. When the contract requires extended product warranties, submit a sample of warranty language.
7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

F. Submit shop or coordination drawings, when specified or the required for the scope of work, which include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

G. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

1.12 PROJECT RECORD DOCUMENTS

A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.

B. Upon submitting his request for final payment, he shall turn over to the Architect/Engineer, for subsequent transmittal to the Owner revised plans showing "as installed" work.

C. In addition to the above, the Contractor shall accumulate during the jobs progress the following data in PDF file format (preferred) or paper copies to be turned over to the Architect/Engineer for checking and subsequent delivery to the Owner:
1. All warranties, guarantees, and manufacturer's directions on equipment and material covered by the Contract.
2. PDF file or paper copies of all Shop Drawing prints and CAD or BIM engineering drawing program files.
3. Any software programs, data/programming files, passwords, special interface cables, or keys that may be needed to maintain or access equipment.
4. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
5. Any and all other data and/or plans required during construction.
6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
7. The first page, or pages, shall have the names, addresses, and telephone numbers of the following:
    a. Builder and all Contractors.
    b. Major Equipment Suppliers
    c. Submit communication systems warranties.

1.13 TRAINING

A. Upon completion of the work and at a time designated by the Architect, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance

of all Electronic Safety Systems equipment and systems.

B. See other sections for time requirements.

1.14 PLANS AND SPECIFICATIONS

A. The intent of the project drawings is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.

B. Electrical drawings are generally diagrammatic and show approximate location and extent of work.

C. Install the work complete including minor details necessary to perform the function indicated. Provide Electronic Safety Systems (including all hook-ups) complete in every respect and ready to operate.

D. If clarification is needed, consult the Architect/Engineer.

E. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer for his interpretation.

F. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

1.15 PRODUCT SUBSTITUTIONS:

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose systems which differ in manufacturer, features, functions, or operating characteristics from those outlined in these specifications must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified and include relevant technical and cost data. This shall include a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

D. The Engineer will consider all such submittals and the Architect will issue an addendum listing items that the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

E. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of the alternate system shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure the system will be an acceptable equivalent.

F. The Contractors’ proposal represents that the contract proposal price is based solely upon the

materials, equipment, and labor described in the Contract Proposal Documents (including addenda, if any) and that he contemplates no substitutions or extras.

G. The manufacturer of the proposed substitute unit shall provide samples for evaluation, when required, at no charge and non-returnable.

H. Requests for substitution are understood to mean that the Contractor:
   1. Has personally investigated the proposed substitution and determined that it is equivalent or superior in all respects to that specified.
   2. Will provide the same guarantee for the substitution that he would for that specified.
   3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
   4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
      a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
      b. The specified product is unavailable through no fault of the Contractor.
      c. The manufacturer refuses to warranty the specified products as required.
      d. Subsequent information indicates that the specified product is unable to perform properly or to fit in the designated space.
      e. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
      f. Revisions to the electrical system caused by substitutions shall be under the supervision of the Engineer, at a standard hourly rate charged by the Engineer. Charges from the Engineer, Architect, and Electrical Contractor shall be paid by the Contractor originating the changes.

1.16 FUTURE USE CABLING

A. When cabling is installed for future use, it shall be identified with a tag of sufficient durability to withstand the environment involved.

B. Locations and Existing Conditions:
   1. Location and condition of any existing equipment or services, when shown, have been obtained from substantially reliable sources, are shown as a general guide only, without guarantees as to accuracy.
   2. The Contractor will examine the site, verify all requirements, service points, and availability of all services required to complete this project. No consideration will be granted for any alleged misunderstanding of the materials and labor to be provided as necessitated by nature of the site including those items that may be fairly implied as essential to the execution and completion of any and all parts of this project.

1.17 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by the Contractor.

1.18 FINAL OBSERVATION

A. It shall be the duty of the Contractor to make a careful observation trip of the entire project, assuring themselves that the work on the project is ready for final acceptance before calling upon the Architect/Engineer to make a final observation.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, et cetera, called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect/Engineer at or before the time of said final observation. The Contractor is cautioned to check over each bond, receipt, et cetera, before preparing for submission to verify that the terms check with the requirements of the specifications.

C. The following and other provision of Division 1 General Conditions will be required at time of final completion:
   1. Final clean up completed.
   2. All systems are fully operational, all material and devices installed.
   3. As built (as installed) drawings and operations manuals.

1.19 PROHIBITED MATERIALS

A. No new asbestos, lead, or materials containing these substances shall be permitted in this project. The Contractor shall consult the Architect concerning these materials if their presence is suspected. All work in or around existing asbestos or lead materials is at the sole risk of the Contractor and his personnel.

1.20 CUTTING AND PATCHING

A. Notify the Builder sufficiently ahead of construction of any floors, walls, ceiling, roof, et cetera, of any openings that will be required for his work.

B. The Contractor shall see that all sleeves required for his work are set at proper times to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, et cetera, as required for the proper installation of the work under this Contract shall be done at the Subcontractor or at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.

D. Patching of openings and/or alterations shall be provided by the Electronic Safety Systems Subcontractor or at the Subcontractor's expense in an approved manner.

E. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

H. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

1.21 MANUFACTURERS' INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the drawings and specifications, manufacturer's instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions.

C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.

1.22 INSTALLATION

A. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts are considered a part of this work. In order to effect timely and accurate placing of work and to bring together, in the proper and correct sequence, the work of such trades, including work provided under a Division 1 allowance.

B. The Electronic Safety Contractor shall coordinate installation of the systems with the Builder, Electrical, Mechanical, and Plumbing Contractors to ensure a complete working system for the Owner.

C. Where required for accessibility all conduit and boxes for all Electronic Safety Systems shall be provided by the Electrical contractor as specified, including systems in Division 28, any and all allowances shall be included. Normally low voltage wiring shall run open and supported in accessible attic space. All low voltage wiring in exposed areas such as gyms, stages, shops, and field houses shall be enclosed in conduit. Coordinate with, and verify with Division 26 to provide required conduit and boxes at locations and heights as required.

D. Conduit, innerduct, track, or raceway shall conceal and protect wiring in exposed areas, within walls, through in- accessible areas, floors, chases, under slab, crawlspaces, or underground.

E. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

F. All work must be performed by workers skilled in their trade. The installation must be complete whether the work is concealed or exposed.

G. Provide stainless screw/bolt hardware wherever stainless devices are used and in potentially wet areas.

H. Coordinate the actual locations of devices and outlets and equipment with building features and mechanical equipment as indicated on architectural, structural, and mechanical drawings. Review with the Architect any proposed changes in outlet or equipment location. Relocation of devices, before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Architect.

1.23 ADDITIONAL MATERIALS: INCLUDE IN THE BASE CONTRACT PROPOSAL

A. All costs to provide 10 additional fire alarm signals including all cable and devices as directed by the Architect. Conduit and standard back boxes by Division 26 Electrical Contractor.

PART 2 – PRODUCTS

A. Not Applicable

PART 3 – EXECUTION

A. Not Applicable

END OF SECTION

SECTION 28 05 44 – BDA/DAS / EMERGENCY RESPONDER RADIO ANTENNA SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Design, furnish, install, and test a complete and operating in-building Emergency Responder Radio Antenna System/Distributed Antenna System [‘system’ or ‘DAS’] to provide complete coverage for the public safety agencies as required by the local fire department, other agencies and the authority having jurisdiction [AHJ]. The system will support only Emergency Responder and Public Safety Land Mobile Radios [‘LMR’]. The system shall not support District Radio, Cellular, and/or Wi-Fi Signals.

1.2 WORK INCLUDES

A. Contractor shall refer to architect’s allowance front end documents for BDA/DAS project allowance.

B. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 apply to this Section.

C. Provide all equipment, materials, labor, supervision and services necessary for or incidental to the installation of a complete Emergency Responder Radio Antenna System. The purpose is to extend and amplify the Emergency Responder and Public Safety Land Mobile Radio signals to a strength of 95% in all areas of the facility including elevators, stairwells and all floors.

D. It shall be the responsibility of the Emergency Responder Radio Antenna System contractor to obtain all required permits, approvals and certifications from the authorities having jurisdiction.

E. All fees associated with the licensing shall be paid by the Contractor.

F. Testing of the system shall conform to the testing requirements as described in the International Fire Code [IFC] Section 510.5.3.

G. All testing must be done on frequencies authorized by the FCC and in use by local agencies as directed by the Authority Having Jurisdiction [AHJ].

H. Final acceptance and approval shall be required from the local AHJ.

I. It shall be the responsibility of the Electrical Contractor to provide and install all conduit systems, standard electrical boxes, and operating power for the building access systems as outlined on the project drawings. This Contractor shall coordinate all system requirements with and provide special back boxes to the Electrical Contractor prior to installation of conduit.

J. The Electrical Contractor shall provide 120-volt power as required through separate dedicated branch circuits, maximum 20 amperes each. Each such circuit shall be labeled at the power distribution panel as EMERGENCY RESPONDER RADIO SYSTEM. The location of all circuit breakers serving the Emergency Responder Radio Coverage System shall be posted in the control unit cabinets. Each cabinet and all surge protection devices shall be grounded securely to the building grounding system.

K. Provide all testing, documentation, training, and warranty service contract as outlined in these specifications.

L. Section shall include:
1. Bi-Directional Amplifiers [BDA's]
2. Distributed Antenna System
3. Coaxial Cables
4. Splitters and Directional Couplers
5. Battery Back-Up System
6. All other equipment and components necessary for a complete and functioning Emergency Responder Radio Antenna System.

1.3 SYSTEM PRICING, PHASING AND AWARD

A. Proposed Contractor shall provide a proposal based on separate pricing for each of the following steps:
1. Outdoor Testing of the Facility – This price shall include verifying the outdoor signal strength at the facility's location.
2. Full Testing, in accordance with IFC Section 510 Grid Testing – This price shall include verification of signal strength throughout the entire facility.
3. Emergency Responder Radio Antenna System Materials and Installation Pricing – This price shall include a full system design and installation, including costs for design, components, materials, labor and testing. This price shall be a "Worst-Case Scenario" situation, as though the entire facility must require coverage.

B. The project must be budgeted as a complete set of processes, thus the reason for having all pricing, in a "Worst-Case Scenario" prior to performing any work. This pricing will provide a budget before the work begins.

C. The award of this work will be made in phases, in accordance with the three (3) afore mentioned steps.
1. Phase I award authorizes step #1. Once step one is completed, results are to be provided to the General Contractor, Architect, and Engineer for review. Following this review, step two may be delayed, pending adjustment to the donor signal. If donor signal strength at the facility does not meet IFC Section 510 requirements, the AHJ must be consulted, prior to moving to step two. If the donor signal strength is adequate to meet IFC Section 510 requirements, authorization for step two will be given.
2. The Phase II award authorizes step #2. Testing of the facility to determine signal strength status and to provide a base for a full system design. After testing, a final revised proposal for a full system design, installation and final testing shall be issued to the General Contractor for review. No further work is authorized until award of Phase III is granted.
3. Phase III award authorizes step #3. Design, installation and final testing of the Emergency Responder Radio Antenna System. Provide design and final acceptance testing documents per Section 1.8.

1.4 MANUFACTURERS

A. Subject to compliance with requirements, available integrators offering products that may be incorporated in the work include, but are not limited to:
1. Farenhyt
2. Axell Wireless
3. Tessco
4. Times Microwave
5. Gamewell-FCI
6. Notifier
7. SOLiD Technologies – Alliance Corporation
8. Other manufacturers upon approval.

1.5 RELATED SECTIONS

A. Section 28 05 00 - General Electronic Safety and Security System Requirements.

B. Section 28 31 00– Fire Detection and Alarm System

1.6 CODES AND REGULATIONS

A. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.

B. The equipment, materials, and installation shall confirm to the latest version of all applicable codes, standards and regulations of authorities having jurisdiction including the following:
   1. NFPA 1 – The National Fire Code (including Annex O from 2009)
   2. NFPA 70 – The National Electrical Code
   3. NFPA 72 – National Fire Alarm Code
   4. NFPA 1221 – Standard for the Installation, Maintenance and Use of Emergency Services Communication Systems
   5. UL 2524 - 1st Edition In-building 2-Way Emergency Radio Communication Enhancement Systems
   6. FCC 47 CFR Private Land Mobile Radio
   7. FCC 47 90.219-2007 Services-Use of Signal Boosters
   8. ICC 2009 International Fire Code, Code and Commentary
   9. ADA “Americans with Disabilities Act”
   10. FCC’s OET 65 Standards “Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields”
   11. FCC Rules Part 22, Part 90, and Part 101

1.7 DEFINITIONS

A. Attenuation: The reduction in signal power, expressed in decibels, as a result of coupling, heat loss, or transmission distance in a cable or in air.

B. Bi-Directional Amplifier [BDA]: A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station for enhanced signals and improved coverage. Also known as a signal booster.

C. Coupled Bonding Conductor [CBC]: a bonding conductor placed on the outside of any technology cable. Used to suppress transient noise.

D. Delivered Audio Quality Definitions [DAQ]: The universal standard often cited in system design, specifications, and testing reports for ERRC and DAS.
   1. DAQ 1: Unusable, speech present but not intelligible.
   2. DAQ 2: Understandable with considerable effort. Frequent repetition required due to noise and/or distortion.
   3. DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise and/or distortion.
   4. DAQ 3.5: Speech understandable with repetition only rarely required. Some noise and/or distortion
   5. DAQ 4: Speech easily understood. Occasional noise and/or distortion.
   6. DAQ 4.5: Speech easily understood. Infrequent noise and/or distortion.
   7. Speech easily understood.

E. Distributed Antenna System [DAS]: A network of service antennas connected at intervals along shielded coaxial transmission lines and all connected to head-end electronics amplifying the signals to be distributed. Often refers to a system that includes both the passive distribution system and the active amplifying electronics.

F. Directional Coupler: A component which directs a small portion of downstream RF energy to a port which can be connected to an antenna or another branch of distribution cabling, and also serves as a combiner of upstream energy between the tap port and through the connection port.

G. Donor Antenna: The antenna, usually mounted on the outside of a structure where a DAS is installed, which picks up signals over-the-air from a donor source.

H. Donor Source: The repeater, transceiver, cell site, or other radio site that produces signals which a DAS will relay and distribute.

I. Emergency Responder Radio Antenna System [ERRAS]: A two-way radio communication system installed to assure the effective operation and coverage of radio communications systems for fire, emergency medical services, and/or law enforcement agencies within a building or structure. The system is not designed for use with District LMR, Cellular Services, or Wi-Fi Services.

J. Federal Communications Commission [FCC]: federal agency responsible for implementing and enforcing America's communications laws and regulations.

K. OET 65 Standards: The FCC's Bulletin that provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

L. Public Safety and/or First Responder: agencies which are charged with the responsibility of responding to emergency situations. These include, but are not limited to, law enforcement, fire departments, and emergency medical services.

M. Reflected Power: Power which is reflected back along a transmission line as a result of discontinuities in line impedance caused at connectors or close proximity of metallic objects.

N. Radio Frequency [RF]: Energy from electromagnetic waves, or alternating currents that produce electromagnetic waves, in the spectrum of radio frequencies (30 kHz to 300GHz)

O. Signal Booster: See BDA

P. Splitter: A passive component that has a single input port and two or more output ports, effectively splitting the signal equally amongst the output ports. It also serves to combine upstream signals from the "output" ports into composite signals at the "input" port.

1.8 SUBMITTALS

A. Submittal procedures: See Section 28 05 00.

B. Submit a complete submittal package within 30 calendar days, for approval, after award of this work. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

C. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

D. Quality Assurance Submittal:
   1. Letter from manufacturer stating that the Contractor is an Authorized Factory Distributor for the area where the project is located.
   2. The Contractor and Manufacturer shall supply sufficient information to indicate that the proposed system is based on the latest hardware, software technology and products comply with specified requirements and FCC Regulations.
   3. The system described in the submittals shall be certified by an FCC Licensed Designer and installation shall be supervised by an FCC Licensed Project or Installation Manager.

E. Product Data Submittal including special boxes, cable and other material as requested by the Architect/Engineer including:
   1. A cover sheet with the name and location of the project, the name, address and telephone number of the Contractor and the name, address and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
   2. Copies of FCC Licenses for both the Designer and Project or Installation Manger.
   3. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
   4. A product data index and complete equipment list including for each product submitted for approval the manufacturers name and part number including options and selections.
   5. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle or other means) on each sheet the exact product and options being submitted for approval.
   6. Submit design data when the scope of work requires, including passband curves for both uplink and downlink for all bands, calculations, schematics, risers, sequences or other data.
   7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.
   8. Any rejected submittals must be corrected and resubmitted to the AHJ and Architect/Engineers within 10 days of receipt of the rejected material.

F. Submit shop drawings locating all components of the system, indicating circuit routing, cable type, and gauge. Shop or coordination drawings shall include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, risers, floor plans and accurate to scale, (minimum of 1/8” = 1’-0”), equipment and device layouts prepared using a CAD or BIM engineering drawing program.

G. Testing
   1. Submit all field test records of the radio systems. These shall include, but not be limited to:
      a. Preconstruction Tests – Tests performed with the AHJ prior to construction of the new facility to verify that the municipality has signal coverage in that area.
      b. Mid-Construction Tests – Tests performed with the AHJ during construction, once walls have been constructed and the exterior roof is installed.
      c. Final Testing – Tests performed in conforming with IFC Section 510.5.3 and Section 510.6. This testing is to be signed off by the AHJ. Engineers shall also be present for the final testing process.
   2. All testing records shall be submitted with O&M information and close out documents.
      a. Provide one (1) digital copy of all close out documents
      b. Provide three (3) copies of closeout documents bound in a 3-Ring binder with dividers and table of contents.

1.9 QUALIFICATIONS OF A PROPOSED CONTRACTOR

A. Proposed contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein described will be disqualified.

B. The proposed contractor, as a business entity, shall be an authorized distributor and designated representative of the emergency responder radio coverage system manufacturer, with full warranty privileges, and shall have been actively engaged in the business of selling, installing, and servicing emergency responder radio coverage systems for a period of at least 5 years.

C. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/ Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.

D. The Contractor shall employ factory trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this training shall be provided with the Contractors submittal.

E. The contractor shall employ full time local technicians and installers. The manufacturer shall maintain a full-time factory employed service staff for product support and service.

F. The proposed Contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period.

G. All testing shall be conducted, documented and signed by a person in possession of an FCC General Radio Telephone Operators License and be a full-time employee of contractor.

H. The proposed contractor shall be fully experienced in the design and installation of the type of system herein specified and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150-mile radius of the school district to allow school administration officials to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

I. The Proposed Contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response. A Proposed Contractor that has any prior finding(s) of a code or license violation or has any litigation in process concerning the installation of a system is unacceptable.

J. The ability of a proposed Contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

K. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

L. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

M. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfill of any part of the contract or to complete the work contemplated therein.

N. The Owner reserves the right to reject the proposal of any Contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

PART 2 – PRODUCTS

2.1 GENERAL

A. The system shall conform to the requirements as identified in IFC Section 510.4 and Section 510.5. Testing records are required to confirm performance of the system.

B. Compatibility: The equipment, including but not limited to repeaters, transmitters, receivers, signal boosters, cabling, fiber distributed antenna systems, etc., shall not interfere with the existing communication systems utilized by the Public Safety and First Responder agencies.

C. Power Supplies: At least two (2) independent and reliable power supplies shall be provided: one primary and one secondary. The primary power source shall be supplied from a dedicated 20-ampere branch circuit and comply with 4.4.1.4 of NFPA 72. The secondary power source shall be a dedicated battery back-up, capable of operating the in-building system for at least 24 hours at 100% operation. The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in one NEMA 4 type enclosure. Monitoring the integrity of the power supplies shall be in accordance with 4.4.7.3 of NFPA 72.

D. Survivability
   1. Fire Performance: All main risers or trunks of the antenna system shall be installed with resistance to attack from fire using one of the following methods:
      a. A 2-hour fire rated cable or cable system
      b. Routing the cable through a 2-hour fire rated enclosure(s) or shaft(s).
   2. Cabinet: The signal booster and all associated equipment shall be housed in a single NEMA 4 certified, painted steel weather tight box. The cabinet shall be large enough to dissipate internal heat without venting from inside of the cabinet to outside atmosphere. Equipment installed on the roof of structures shall be rated for the expected extreme temperature and weather associated with rooftop installation.
   3. Rooftop Installations shall require a Pitch Pocket for proper weather-tight roof penetrations.
   4. Passive equipment: Passbands shall be VHF, UHF, and 700-900 MHz, IP rating of 2GHz.

2.2 SYSTEM COMPONENTS

A. Signal Strength
   1. Downlink: A minimum signal strength of -95dBm shall be provided throughout the coverage area.
   2. Uplink: A minimum signal strength of -95 dBm shall be received at the local municipality from the coverage area.
   3. A donor antenna must maintain isolation from the distributed antenna system. The donor antenna signal level shall be a minimum of 15 dB above the distributed antenna system under all operating conditions.

B. Permissible Systems
   1. Buildings and structures shall be equipped with an FCC Certified Class B Bi-Directional VHF, UHF, and 700-900 MHz amplifier(s) as needed.
   2. The distributed antenna system may utilize a radiating cable, fixed antennas, or a combination of both.

C. Supported Frequencies: The system shall support VHF, UHF, and 700-900 MHz as required for local public safety and first responder bands as utilized by the local municipality.

D. Reject Filters: Notch filter sections shall be incorporated as necessary.

E. Band Migration Capability: The signal booster shall include re-tunable or replaceable filters to accommodate rapid and economic passband changes in the event of mandatory FCC changes with the NPSPAC band. The use of non-adjustable and non-replaceable RF input and output filters is prohibited.

F. Output Level Control: An automatic output leveling circuit shall be included for both passbands with a minimum dynamic range of 60 dB, less any gain reduction setting, to maintain FCC out of band and spurious emission compliance.

G. Degraded Performance in Emergencies: The system shall be designed to allow degraded performance in adverse conditions, such as abnormally high temperatures resulting from nearby fires, extreme voltage fluctuations and/or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over voltage, over/under current, over/under temperature, etc.) shall not be implemented as the standard mode for public safety applications.

H. Mode of Operation: The system shall be normally powered on and shall continuously provide passing of frequencies within the Public Safety and First Responder bands.

I. All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.

2.3 SYSTEM MONITORING

A. The distributed antenna system shall include connections to the fire alarm system to monitor the operational integrity of the signal booster, power supplies and annunciate malfunctions on the fire alarm system. Coordinate and provide this integration, as part of this system, with the fire alarm system contractor that is authorized to service the facility's fire alarm system. The integration of the DAS with the fire alarm system shall comply with Chapter 10 of NFPA 72.

B. A sign shall be located at the fire alarm panel with the name and telephone number of the local municipality indicating that they shall be notified of any failures that extend past the 2-hour time limit.

C. A dedicated supervised monitoring panel shall be provided within the emergency command center or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:
   1. Normal AC power
   2. Signal booster trouble
   3. Antenna Failure
   4. Loss of normal AC power
   5. Failure of battery charger
   6. Low battery capacity

2.4 CABLE ROUTING, INSTALLATION, AND SUPPORT

A. System wiring, and equipment installation shall be in accordance with good engineering practices. Wiring shall meet all state and local electrical code requirements.

B. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.

C. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

D. Before energizing the system check all cables for correct connections and test for short circuits, ground faults, continuity, and insulation.

E. In all exposed areas such as mechanical rooms, parking garages, stairwells, etc., cable shall be fully enclosed in conduit.

F. Do not attach any supports to joist bridging or other lightweight members. The support system shall provide a protective pathway to eliminate stress that could damage the cabling.

G. Mount all equipment firmly in place such that vibration or jarring will not interfere with system operation. Route cable in a professional, neat, and orderly installation.

H. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

I. Cable must not be fastened to electrical conduits, mechanical ductwork or piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel for more than four-feet with line voltage electrical conductors. System cables shall not be run loose on ceiling grid or ceiling tiles.

J. Provide for adequate ventilation to all equipment housings and take precautions to prevent electromagnetic or electrostatic hum.

K. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

L. Each cable run shall be free of splices. No terminations, splices, or equipment will be installed in or above ceilings.

M. Do not route any communication cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

N. System cable will not be installed in the same conduit, duct, or track with line voltage electrical cable.

O. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

PART 3 EXECUTION

3.1 COORDINATION

A. Contractors shall coordinate with an FCC licensed engineering firm regularly employed in the business of designing and implementing Emergency Responder Radio Antenna Systems for emergency responders.

B. Electrical Work:
   a. Proposed Contractor is required to provide for and coordinate with Electrical Contractor for any, and all required electrical work, including but not limited to, circuiting, conduits, back boxes, and more. These expenses will not be included in the electrical contractor primary bid.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment model and serial identification numbers.
B. Store and protect equipment in a conditioned space until installation.

3.3 SYSTEMS INSTALLATION

A. Coaxial antenna cabling shall not be installed in the same conduit, raceway, or cable trays used for other systems.
B. All equipment shall be connected according to the OEM's specifications to insure correct installation and system performance.
C. Coordinate all roof penetrations with General Contractor and/or Roofing Contractor.

3.4 GROUNDING

A. Ground cable shields and equipment per Manufacturer's requirements.

B. Antenna mast shall be grounded per NFPA 70 NEC requirements and antenna manufacturer's requirements. Provide grounding blocks and surge protection for outside coaxial cabling. Bond the antenna mast to the existing lightning protection system.

3.5 TESTING, WARRANTY SERVICE

A. A factory trained representative of the manufacturer shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect/Engineer and Owner. All testing shall meet the testing standards set forth in IFC Section 510.

B. This contractor will thoroughly test all components of the systems and devices proposed herein to assure equipment specifications are met. This contractor will start up, test, and debug systems to ensure that all aspects of the system are working, documented, and reporting properly.

C. This Contractor shall make a thorough inspection and test of the complete installed Emergency Responder Radio Antenna System including all components and controls to ensure the following:
   1. Complete and functional system.
   2. Installed in accordance with manufacturer's instructions.
   3. Verify proper operation and processing of signals.
   4. Verify that units and controls are properly labeled, and interconnecting wires and terminals are identified.
   5. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense.

D. A final System Acceptance Test shall be performed in the presence of a designated Owner representative and the AHJ. In the event that a system does not pass or only partially passes

the Acceptance Test, the Project Manager will file a discrepancy report. Corrected items will be re-tested via a punch list to ensure that they comply with the system requirements.

E. This Contractor shall provide a warranty of the installed system against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment, cabling or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one-year warranty or manufacturer's warranty whichever is greater.

F. Immediately prior to the end of the warranty period, the system shall be inspected and certified for the following year at no additional cost to the Owner.

3.6 DRAWINGS, MANUALS, AND TRAINING

A. As-built drawings and operating and maintenance manuals may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

B. Upon completion of the installation, and prior to final inspection, the Contractor shall furnish as-built drawings.

C. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Include copies of all calculation sheets used to configure the system.

D. Formal on-site training sessions shall be conducted by the Emergency Responder Radio Antenna System contractor. It shall be the responsibility of the Contractor to coordinate time and location of training sessions with the Owner. Provide documented general instruction as follows:
   1. Provide instruction to the maintenance personnel to include the location, inspection, normal maintenance, testing, and operation of all system components. Provide a minimum of four (4) hours—two 2-hour sessions separated by a minimum of two weeks.
   2. Provide instruction to designated personnel on the functions and operation of the system provided including capabilities, limitations, and the meaning of status messages. State the proper procedure for testing, routine maintenance, and request for service. Provide detailed instruction on the operation of the system. Provide a minimum of four (4) hours—two 2-hour sessions separated by a minimum of two weeks.

END OF SECTION

SECTION 28 13 00 – ACCESS CONTROL SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 RELATED WORK

Division 26 work as applicable
28 05 00 – General Electronic Safety Systems Requirements

1.2 WORK INCLUDED

A. The Contractor shall furnish and install a complete microprocessor based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system. **This scope of work shall be carried in an Allowance.**

B. Security system device locations are shown for coordination. The contractor shall coordinate exact location with the Owner and all other required trades prior to installation. The installing contractor shall design and provide a complete system, meeting the requirement of specification. The Contractor shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.

C. The system shall include Security Card reader access interfaces at all locations noted.

1. The Control System shall be the product of a single manufacturer.
2. Tag all conductors or cables at each end.
3. Installation of security panels in the building MDF. Additional panels shall be installed in IDF locations as required.
4. Installation of modules and cards.
5. Interconnection of security panels.
6. Installation of new security devices.
7. Integration with Intrusion Detection and Video Surveillance systems. Primary panel interface shall be the Access Control Panel.
8. Installation of all Card Reader, Door Contacts (DPDT), and other field devices.
9. Provide cabling and interconnection of electrified door hardware to the access control system.
10. Provide graphical layout of the floorplan with all systems included for ease of supervision.
11. Preconstruction meeting with Owner’s personnel, installing technician and project superintendent.

D. The contractor shall integrate the system with the video surveillance system and the intrusion detection system for monitoring and direct communication with the District’s monitoring company for all intrusion points. All intrusion points shall be included within the Open Options monitoring point group list for the intrusion detection system.

E. Contractor shall provide all permits, licenses and system certifications as required by Authority Having Jurisdiction.

1.3 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

A. National Fire Protection Association Standards:
   1. NFPA 70 National Electric Code
   2. NFPA 72 National Fire Alarm Code
   3. NFPA 101 Life Safety Code

B. Local & State Building Codes

C. Requirements of Local Authorities having Jurisdiction

D. Underwriters Laboratory Requirements and Listings for use in Security Alarm Systems.

E. Requirements of American Disabilities Act (Public law 101-336).

F. Texas Accessibility Standards (T.A.S.)

G. State Fire Marshall.

H. Texas Insurance Code.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:
   1. The installing contractor shall be the authorized representative of the Access Control Manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least two years.

   2. Integrated Wiegand Output, Wireless, and IP-Enabled access control products are required to be supplied and installed only through designated ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) accounts.

   3. Integrated Wiegand Output, Wireless, and IP-Enabled access control products are required to be supplied and installed only through designated ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) accounts.
   3. The installing contractor shall be licensed by the State of Texas as a security services contractor to design, sell, install, and service security alarm systems.
   4. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
   5. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
   6. All Contractors must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.
   7. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
   8. Contractor must be a current integrator of the specified solution in the closet major metropolitan area marketplace, have a permanent office located within 75 miles of the project, and be able to include information on current support staff to be able to service this client.

1.5 SUBMITTALS

A. The installing contractor and/or equipment supplier shall provide complete and detailed shop

drawings and include:

1. Control panel wiring and interconnection schematics.
2. Complete point to point wiring diagrams.
3. Riser diagrams.
4. Complete floor plan drawings locating all system devices.
5. Factory data sheets on each piece of equipment proposed.
6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
7. Complete system bill of material.
8. **Line by line specification review stating compliance or deviation.**

B. All submittal data will be in bound form with Contractor's name, supplier's name, project name, and state security license number adequately identified.

1.6 ALTERNATE AND ALTERNATIVE PROPOSALS

A. None.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND INSTALLERS

A. **Open Options**
16650 Westgrove, Ste 150
Addison, TX 75001
855.818.7001
http://www.ooaccess.com

2.2 MAIN ACCESS CONTROL PANEL

A. Main access control panel: Open Options MS-ICS. Contractor shall provide sufficient number of controllers to monitor all card reader locations shown on plan plus two additional for future expansion of system.

B. Provide local communication port at each panel for local configuration of system with laptop.

C. Locate all main control panels in MDF room of building or alternate location provided by the Owner.

D. Provide all enclosures per manufacturer recommendations.

E. Provide and install door controllers in quantities as required to accommodate 110% of access control doors shown on drawings

F. **Final software configuration / programming of system integration will require owner / contractor consultation.**

G. Access Control Software shall be Open Options DNA Fusion with Open Options Open-dX personal data exchange. The Access Control System shall seamlessly integrate with the Video Management System.

2.3 FIELD DEVICES

A. Card Access Equipment
1. Card-Reader Power: Powered from its associated controller, including its standby

power source, and shall not dissipate more than 5 W.

2. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.

3. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:
   a. Indoors, controlled environment.
   b. Indoors, uncontrolled environment.
   c. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

4. Display: Digital visual indicator shall provide visible **[and audible]** status indications and user prompts. Indicate power on or off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.

5. Proximity Readers:
   a. Active-detection proximity card readers shall provide power to compatible credential cards through magnetic induction, and shall receive and decode
      a unique identification code number transmitted from the credential card.
   b. The card reader shall read proximity cards in a range from direct contact to at least 6 inches (150 mm) from the reader.
   c. **Card Readers shall be HID iClass SE R40 Seos cards and fobs (where applicable, confirm with owner prior to construction), and include Life Safety Power BDM.**
   d. Contractor shall provide 250 qty. HID proximity cards with HID iClass embedded chip for each school campus. Coordinate Card type with owner prior to purchase

6. Touch-Plate and Contactless Card Reader: The reader shall have "flash" download capability to accommodate card format changes. The card reader shall have capability of transmitting data to security control panel and shall comply with ISO/IEC 7816.

7. Credential Card Modification: Entry-control cards shall be able to be modified by lamination direct print process during the enrollment process without reduction of readability. The design of the credential cards shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the badge holder used at the site.

8. Card Size and Dimensional Stability: Credential cards shall be 2-1/8 by 3-3/8 inches (54 by 86 mm). The credential card material shall be dimensionally stable so that an undamaged card with deformations resulting from normal use shall be readable by the card reader.

9. Card Material: Abrasion resistant, nonflammable, nontoxic, and impervious to solar radiation and effects of ultraviolet light.

10. Card Construction:
    a. Core and laminate or monolithic construction.
    b. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.
    c. Furnish equipment for on-site assembly and lamination of credential cards.

11. ENROLLMENT CENTER

a. Equipment for enrolling personnel into, and removing personnel from, system database, using central-station equipment.

b. Enrollment equipment shall support encoding of credential cards including cryptographic and other internal security checks as required for system.

i. Allow only authorized entry-control enrollment personnel to access the enrollment equipment using passwords.
ii. Include enrollment-subsystem configuration controls and electronic diagnostic aids for subsystem setup and troubleshooting with the central station.
iii. Enrollment-station records printer shall meet requirements of the report printer.

c. Entry-Control Enrollment Software:

i. Shall include database management functions for the system, and shall allow an operator to change and modify the data entered in the system as needed.
ii. Software shall not have alarm response or acknowledgment functions as a programmable function.
iii. Multiple, password-protected access levels shall be provided at the enrollment station.
iv. Database management and modification functions shall require a higher operator-access level than personnel enrollment functions.
v. Software shall provide a means for disabling the enrollment station when it is unattended, to prevent unauthorized use.
vi. Software shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations to include a credential unit in use at the installation.
vii. In the case of personnel identity-verification subsystems, this data shall include biometric data.
viii. Software shall allow entry of this data into the system database files through the use of simple menu selections and data fields. The data field names shall be customized to suit user and site needs.
ix. Personnel identity-verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.

d. System Capacity: Number of badges shall be limited only by hard disk space. Badge templates and images shall be in color, supporting the maximum color capability of Microsoft Windows.

e. Badge Configuration:

i. Software for badge template creation shall include a template consisting of background and predetermined locations of photographs, text objects and data fields for text, and bar-code and biometric information. Include automatic sizing of data fields placed on a badge to compensate for names, which may otherwise be too large to fit in the area designated.
ii. Allow different badge templates to be used for each department, tenant, or visitor.
iii. As a setup option, templates shall be automatically selected for the badge, based on the group to which the credential holder is assigned. Allow the operator to override the automatic template

selection and use a template chosen by the operator for creating a badge.

iv. Setup shall determine which graphics and credential-holder information will be displayed and where on the card it will be placed. All data in the security access system, such as name, code, group, access level, and any of the 99 user-defined fields, shall be selectable, with the ability to place them anywhere on the card.

v. System shall include an importing, filing, and recall system of stored images and shapes that can be placed on the badge.

vi. Allow multiple images on the same badge, including, but not limited to, bar codes, digital photos, and signatures. Support transparent backgrounds so that image is only surrounded by the intended background and not by its immediate background.

f. Photo Imaging: Integral to security access.

i. Import images from bitmap file formats, digital cameras, TWAIN cameras, or scanners. Allow image cropping and editing, WYSIWYG badge-building application, and badge print-preview and printing capabilities.

ii. System shall support multiple images stored for each credential holder, including signatures, portrait views, and profile views.

g. Text Objects: Badge configuration shall provide for creation of custom text as an object, allowing font selection, typing, scaling, and formatting of the text object. Formatting options shall include changing font, font size, text flow, and text alignment; bending or curving the text object into a circle or semicircle; applying 3-D effects; and applying predefined effects such as tilt, extrusion, or beveling. Text shall be placed and optionally automatically centered within any region of the badge layout.

h. Badges and Credential Cards:

i. Badges are credential cards that do not contain data to be read by card readers.

ii. Credential cards shall store uniquely coded data used by card readers as an identifier.

a. Magnetic-Stripe Cards: Comply with ISO/IEC 7810, ISO/IEC 7811-1, ISO/IEC 7811-2, ISO/IEC 7811-6, and ISO/IEC 7811-7. Use single-layer magnetic tape material that is coated with a plastic, slick protective coat and affixed to the back of the credential card near the top.

b. Wiegand Wire-Effect Cards: Ferromagnetic wires laminated into the credential card using binary digits specified for Wiegand readers to generate a unique credential card identification code.

c. Proximity Cards: Use proximity detection without physical contact with the reader for proper operation.

iii. Allow entry-control card to be modified by lamination or direct print process during the enrollment process for use as a picture and identification badge without reduction of readability. The design shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the type of badge holder used at the site.

a. Card Size and Dimensional Stability: Standard size, 2-1/8 by 3-3/8 inches (54 by 86 mm); dimensionally stable so that an undamaged card with deformations resulting

from normal use shall be readable by the card reader.

b. Card Material: Abrasion resistant, nonflammable, and nontoxic; and impervious to solar radiation and effects of ultraviolet light.

c. Card Construction: Core and laminate or monolithic construction. Lettering, logos, and other markings shall be hot stamped into the credential material or direct printed.

i. Furnish equipment for on-site assembly and lamination of credential cards.

d. Card Durability and Maintainability: Designed and constructed to yield a useful lifetime of at least five years or 5000 insertions or swipes, whichever results in a longer period of time. Allow credential cards to be cleaned by wiping with a sponge or cloth wetted with soap and water.

i. Card-Making Equipment: Consisting of a workstation, video camera, video-imaging equipment, and a printer.

i. Camera: NTSC color standard, RGB video output, 470 lines minimum horizontal resolution, and automatic white balance with full rated output under illumination of 0.5 fc (5 lx).

ii. Video Imaging: Live-image capture software and hardware and a digital signature capture pad.

iii. Standard workstation, modified as follows:

a. Redundant workstation is not required.

b. Printer is not required.

c. UPS is not required.

d. Sound card is not required.

iv. Printer: Dye-sublimation resin thermal transfer, 300 dpi resolution, 16.7 million colors, accepting cards ranging in size from 2.1 by 3 inches to 2.6 by 3.7 inches (53 by 76 mm to 66 by 94 mm) and having card thickness ranging from 0.020 to 0.060 inch (0.5 to 1.5 mm). Printer shall have options for encoding magnetic stripe using tracks 1, 2, and 3. Throughput shall be not less than 60 seconds per card.

12. Provide Ethernet Network Interface to connect school to district-wide access control system. Connect to local area network.

13. Contractor shall provide all cabling and accessories required to provide complete access control access control solution and proper integration with building burglar alarm system for door contact shunting.

14. Provide all controllers as required to connect all card reader locations shown on plan plus 10% or two (2) additional, whichever is greater.

B. Additional Required Equipment, including but not limited to:

1. Open Options SSP-D2
2. Open Options RSC-1
3. Open Options RSC-2
4. Life Safety Power networked power supply #FPO150-B100 2D8PM8NL4E4M/P8-A, or approved Life Safety Power equivalent, and all required appurtenances to provide a fully functional system. Provide quantity as required to provide 8 hours of battery power.
5. Life Safety Power equivalent of Altronix Relay Part # RB1224 will be required for each door that is locally powered to transition the power back to the panel.

6. Power Supplies
    i. Life Safety Power 8-door PART# FPO150-B100C8D8PE6M
    ii. Life Safety Power 16-door PART# FPO150/250-2D8P2M8NL4E8M2
    iii. Or APPROVED Life Safety Power equivalent.
    iv. Contractor to Provide and Install Life Safety power supplies totaling enough doors for all access control doors on Issued construction Documents, plus 8 extra doors.

C. POWER OVER ETHERNET ACCESS CONTROL
D. IP Enabled Power-over-Ethernet (PoE) Integrated Card Reader Mortise Lock: IP enabled ANSI/BHMA A156.13 Grade 1 mortise lockset with integrated credential reader, request-to-exit, and door position signaling in one complete unit. Motor driven locking/unlocking control of the lever handle trim, 3/4" projection latchbolt, and optional 1" steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
E. Completely intelligent and integrated locking unit with Ethernet power and communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding PoE Endspan and Midspan devices) via an existing or newly installed IEEE 802.3af PoE enabled network.
F. Open architecture design supports wired integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with inside lever handle (request-to-exit), battery status, tampering, and door position (open/closed status) monitoring.
G. 2,400 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand alone operation in absence of network communication allowing for system operational redundancy.
H. Provide a network and lock configuration CD tool kit for initial lock setup and programming via a USB connection.
I. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
J. Integrated reader supports the following credentials:
K. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
L. 13.56 MHz contactless credentials: HID iClass, HID iClass SE, HID iClass Seos, SIO on MIFARE Classic, SIO on MIFARE DESFire EV1, MIFARE Classic, DESfire EV1, NFC-enabled mobile phones, Bluetooth Smart-enabled mobile phones.
M. Communication between access control system and device is protected by AES 128 bit encryption via the SDK. Programmable for time zones, holidays, and automatic unlocking.
N. Power and communication from one Ethernet (CAT5e or higher) cable. Compliant with 802.3af Class 1 device specifications requiring 3.84 watts for Power over Ethernet.
O. Supports real-time system lockdown capabilities. Inside lever retracts latch bolt and deadbolt simultaneously.
P. High security mechanical key provides emergency override retraction of latchbolt without need for electronic activation.
Q. Ethernet system framework, network cabling, mounting boxes, PoE end-span/mid-span, electrical hard wiring, grounding, and connections are required for complete system functionality. All system components are by others and are specified elsewhere.
R. Power Requirement: PoE Class 2, maximum 7 watts.
S. Network Cabling Requirements: Cat5e or higher meeting or exceeding ANSI/TIA/EIA-568-C. 24 AWG Plenum rated.
T. Bonding and Grounding: Meet or exceed TIA-607-B requirements. Connect device ground cable to building electrical earth ground.
U. Network Surface Mount Box: Meet or exceed ANSI/TIA/EIA-568-C requirements. Cat5e or higher (RJ45).
V. Manufacturers:
W. Sargent Manufacturing (SA) – SN200 - 8200 Series. Provided by Division 8 (Security contractor shall coordinate with architect and owner prior to construction).
X. IP Enabled Power-over-Ethernet (PoE) Integrated Card Reader Exit Hardware: IP enabled, PoE

ANSI/BHMA A156.3 Grade 1 rim and mortise exit device hardware with integrated credential reader, touchbar monitoring, and request-to-exit signaling in one complete unit. Motor driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or fire exit hardware for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override trim.

Y. Completely intelligent and integrated locking unit with Ethernet power and communication connection capability directly from the locking unit back to the central system host server without additional access control interfaces or components (excluding PoE Endspan and Midspan devices) via an existing or newly installed IEEE 802.3af PoE enabled network.

Z. Open architecture design supports wired integration with third party access control systems applications via software development kit (SDK). Real-time software accessible alarms for forced door, unknown card and door held open, with push rail (request-to-exit), battery status, tampering, and door position (open/closed status) monitoring.

AA. 2,400 users and 10,000 event transaction history (audit trail). Distributed intelligence allows stand alone operation in absence of network communication allowing for system operational redundancy.

BB. Provide a network and lock configuration CD tool kit for initial lock setup and programming via a USB connection.

CC. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

DD. Integrated reader supports the following credentials:

EE. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.

FF. 13.56 MHz contactless credentials: HID iClass, HID iClass SE, HID iClass Seos, SIO on MIFARE Classic, SIO on MIFARE DESFire EV1, MIFARE Classic, DESfire EV1, NFC-enabled mobile phones, Bluetooth Smart-enabled mobile phones.

GG. Communication between access control system and device is protected by AES 128 bit encryption via the SDK. Programmable for time zones, holidays, and automatic unlocking.

HH. Power and communication from one Ethernet (CAT5e or higher) cable. Compliant with 802.3af Class 1 device specifications requiring 3.84 watts for Power over Ethernet.

II. Supports real-time system lockdown capabilities

JJ. High security mechanical key provides emergency override retraction of latchbolt without need for electronic activation.

KK. Ethernet system framework, network cabling, mounting boxes, PoE end-span/mid-span, electrical hard wiring, grounding, and connections are required for complete system functionality. All system components are by others and are specified elsewhere.

LL. Power Requirement: PoE Class 2, maximum 7 watts.

MM. Network Cabling Requirements: Cat5e or higher meeting or exceeding ANSI/TIA/EIA-568-C. 24 AWG Plenum rated.

NN. Bonding and Grounding: Meet or exceed TIA-607-B requirements. Connect device ground cable to building electrical earth ground.

OO. Network Surface Mount Box: Meet or exceed ANSI/TIA/EIA-568-C requirements. Cat5e or higher (RJ45).

PP. Manufacturers:

QQ. Sargent Manufacturing (SA) – SN200 - 80 Series. **Provided by Division 8.**

RR.

2.4 CABLE

A. The contractor shall provide and install Belden Composite Cable for all locations.

B. Reader Cables shall be 6-conductor as manufactured by Belden, routed separately from the Electric Strikes or ELR cables

C. Electric Strikes and Electric Latch Retraction cables shall be 2-conductor as manufactured by Belden, if routed separately from the reader cables

D. Contractor shall provide all cabling, connectors and terminations required to connect door hardware to the access control system.

2.5 HARDWARE

Doors: COORDINATE EXACT LOCATIONS WITH ARCHITECT. Description: Ext - Alum - Pair - Rim/ SN200, EL - KRM - Closer/stop Provided by Division 8 – coordinate with architect prior to construction.

1	Access Control Rim Exit	LC 10 16 43 SN200-8878 BIPS B ETJ LC VK Keys GMK US32D SA
1	Cylinder	By 087100 US32D SA
1	Electric Power Transfer	CEPT-NW By 087100 S

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times. All cylinders by Div8.

Set: 8.0 **Provided by Division 8.**
Doors: (Coordinate exact locations with architect).
Description: Int - Alum - Sgl - SN200 Lock - Closer

1	Access Control Mort Lock	SN200-82278 IPS B LNJ LC VK Keys GMK US26D SA
1	Cylinder	By 08710 US32D SA
1	Electric Power Transfer	CEPT-NW By 08710 SU

Notes: Doors normally closed and secured, free egress at all times. Credential will allow access. All cylinders by Div8.

PART 3- EXECUTION

3.1 INSTALLATION

A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.

C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.

E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

H. Network Connection Cable: Provide a 4 pair Category 6 data cable from the Master Control Panel to the MDF network rack. Category 6 cable shall be purple in color.

I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.

J. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

K. Integrated Wiegand access control products, campus locks, and IP enabled products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.

3.2 CABLE PATHWAYS

A. Cable Support:
1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
   a. Approved Cable Support Product:
      PANDUIT® Corporation J-MOD™ modular support system (sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.
2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the treaded rod.
3. J-MOD™ cable support shall be installed at a maximum of 5' on center.
4. All cable installed shall be attached to the J-MOD™ support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each J-MOD™ cable support to keep wires neatly bundled throughout the entire run. Tiewraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. **ABSOLUTELY NO CABLE, NOT INSTALLED IN CONDUIT, WILL BE ALLOWED TO BE ATTACHED DIRECTLY TO THE BUILDING'S STEEL OR SUPPORTED IN ANY OTHER METHOD THAN THAT STATED ABOVE.**
6. **IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO COORDINATE WITH ALL OTHER TRADES ON THE PROJECT TO INSURE THAT THE PATHWAY OF THIS SYSTEM DOES NOT INTERFERE WITH THE INSTALLATION OF THE OTHER TRADES AND TO PREVENT THE INSTALLED PRODUCT OF OTHER TRADES FROM PUTTING STRAIN ON THE INSTALLED WIRING.**

B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general

electrical section of the specifications, and per NEC.

3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. BUSHINGS MUST BE INSTALLED PRIOR TO INSTALLING CABLE. CUTTING BUSHING TO INSTALL AROUND INSTALLED CABLES WILL NOT BE ACCEPTED.

3.3 TESTING

A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.

B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 WARRANTY

A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

3.5 SOFTWARE

A. Provide two electronic copies of the final programming and program software to the Owner’s Security Supervisor after final approval.

END OF SECTION

SECTION 28 16 00 - INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 RELATED WORK

26 05 00 – Grounding and Bonding
26 02 00 - Basic Materials and Methods
26 05 29 – Electrical Hangers and Supports
26 05 33 – Raceway and Boxes
28 00 00 – Basic Materials and Methods
28 13 00 - Access Control System
28 13 53.11 – IP Network Compatible Intercom
28 23 00 – IP Video Surveillance System

1.3 SECTION INCLUDES

A. Integrated Digital Alarm Communicator and Access Control System (DACS), including but not limited to the following:
   1. Control panel.
   2. Enclosures.
   3. Lock and key.
   4. Power Supplies.
   5. Accessories required to provide a complete DACS.
   6. System O and I manual.
   7. System programming.
   8. Batteries.
   9. Wiring.
   10. Conduits.

B. The Contractor shall be responsible for identifying requirements for permits from the local police department for the installation of the alarm system specified herein and shall assist the Owner in obtaining the relevant alarm permits.

1.4 SYSTEM DESCRIPTION

A. A functionally complete, integrated Digital Alarm Communicator System (DACS) per manufacturer's guidelines, codes and specification requirements.
   1. The DACS shall include a Control Panel with built-in Ethernet jack for event communication and remote services.
   2. The DACS shall include a Control Panel with an optional, supervised telephone line interface module.
   3. The DACS shall include recording and retention of event information in a dedicated event log.
   4. The DACS shall incorporate an integral real-time clock, calendar, and a test timer.
   5. The DACS shall incorporate battery charging capabilities with supervision of battery voltage and battery leads.
   6. The DACS shall accommodate a time / event-based scheduling system.
   7. The DACS shall be capable of supervision of peripheral devices and

communications interfaces.

8. The DACS shall accommodate configuration and operation of separate, independent areas.
9. The DACS shall accommodate hard-wired or wireless point expansion via eight-point interface modules and RF receivers.
10. The DACS shall accommodate addressable expansion utilizing a 2-wire bus.
11. The DACS incorporate removable terminal strips for wiring connection to facilitate simple service and replacement
12. The DACS shall have electrically supervised detection loops and power supplies with battery(s) maintenance. This supervision shall be programmable for the purposes of reporting this information to the DACR.
13. The DACS shall be capable of sending (manually or automatically) test and status reports to remote DACRs.
14. The DACS shall be able to accommodate test, diagnostics, and configuration programming functions locally or remotely via a portable programmer or a computer running the Remote Programming Software (RPS).
15. The DACS shall annunciate alarm, trouble, service reminders, and other relevant system status messages in custom English, Latin American Spanish, Portuguese and/or French Canadian text at the ACC.
16. DO NOT DEVIATE FROM THE FOLLOWING SYSTEM COMPONENTS:
    a. Provide one dry contact per partition for lighting controls relay at the main security panel location in the MDF. The Building Management Control System will monitor this contact.
    b. Include phone line access to remotely turn intrusion alarm "on" and "off."
    c. Provide motion detectors (mostly in corridors) and keypads in locations as shown on attached floor plan. Use the following motion detector setup reference:
        - Elementary Schools:
            - All exterior doors.
            - Long hallways at intersections.
            - 2 in cafeteria/gymnasiums.
            - 2 in library.
            - Stairwell landings at multi-level buildings.
        - Junior High Schools:
            - All exterior doors.
            - Long hallways at intersections.
            - 2 in cafeteria.
            - 2 in each gymnasium.
            - 2 in library.
            - Stairwell landings at multi-level buildings.
        - High Schools:
            - All exterior doors.
            - Long hallways at intersections.
            - 3 in main cafeteria.
            - 3 in 9th grade cafeteria.
            - 2 in each gymnasium.
            - 3 in library.
            - 4 in natatorium (not including main entrance vestibule).
            - Stairwell landings at multi-level buildings.
        - Attic stock per school:
            - D9127U Pop-it module – 10
            - B308 Octo-output – 2
            - B208 Octo-Input – 2
            - B942 Touch Screen Keypad - 2
            - B9512G Panel – 1

- D1640 Transformer – 1
- Sounders – 5
- Strobes – 5

d. Stand-alone system; not tied to the CCTV system.
e. In case of product failure after warranty or the need arises to expand the system in the future, system installed should allow for off the shelf motion detectors and other system components.
f. Power supply should not be in a continuous loop, where one failure could affect several intrusion alarm components.
g. No Wire Mold or exposed wiring in Public accessible areas.
h. Quality of Products (wiring and components) identified in the Specifications

17. The IDS will be integrated / tied to the access control system. Upon a valid read at a credentialing device, the access control system shall send a signal to the IDS to disarm. There shall be a separate “arming” card reader that will allow the system to be armed.

1.5 REFERENCES

A. National Electric Code, Article 760.

B. National Fire Alarm Code (NFPA 72).

C. Administrative Council for Terminal Attachments (ACTA):
1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.

D. American National Standards Institute (ANSI):
1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

E. Federal Communications Commission (FCC):
1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.
2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).

F. The National Institute of Standards and Technology of the United States of America (NIST):
1. Federal Information Processing Standards Publications 197 (FIPS 197) – Advanced Encryption Standard (AES).

G. International Organization For Standardization (ISO):
1. 9001 - Quality System.

H. Underwriters Laboratories, Inc. (UL):
1. UL 50 - Enclosures for Electrical Equipment.
2. UL 294 – Access Control System Units.
3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.
4. UL 609 - Local Burglar Alarm Units and Systems.
5. UL864 – Control Units and Accessories for Fire Alarm Systems (Commercial Fire)
6. UL 1076 – Proprietary Burglar Alarm Units and Systems
7. UL 1610 - Central Station Burglar-Alarm Units.
8. UL 60950-1 - Information Technology Equipment - Safety.
9. UL 636 – Hold up alarms

1.6 SUBMITTALS

A. Product Data: Manufacturer's data, user and installation manuals for all equipment and software programs including computer equipment and other equipment required for complete Digital Alarm including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Control panel wiring and interconnection schematics.
   5. Complete point to point wiring diagrams.
   6. Riser diagrams.
   7. Complete floor plan drawings locating all system devices.
   8. Factory data sheets on each piece of equipment proposed.
   9. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
   10. Complete system bill of material.
   11. Line by line specification review stating compliance or deviation.

B. Shop Drawings: Shop drawings shall provide details of proposed system and the work to be provided. Include point-to-point drawings of systems and wiring diagrams of individual devices.
   1. Detailed wiring diagrams and system description.
   2. System device locations on architectural floor plans.
   3. Full Schematic of system, including wiring information for all devices.

C. Documentation to be submitted by the Contractor upon completion of system installation:
   1. "As-builts": Upon completion of installation, the Contractor shall prepare "as- built" drawings of the system. These "As-builts" shall be delivered electronically (PDF) and as 30 inches by 42 inches (76 cm by 107 cm) format mylar reproducible drawings of each floor plan indicating exact device locations, panel terminations, cable routes and wire numbers as tagged and color-coded on the cable tag.
      a. Additionally, final point-to-point wiring diagrams of each type of device (on 30 inches by 42 inches (76 cm by 107 cm) format) shall be included in the "as-builts."
      b. "As-builts" shall be submitted to the Owner for approval prior to the system acceptance walk-through.
   2. Operation and maintenance manuals: Three sets of operating manuals shall be provided explaining the operation and maintenance of the system.
   3. Parts list.
   4. Maintenance required and maintenance schedule.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualification:
   1. The system shall be the standard product of one manufacturer, and the manufacturer shall have been in business manufacturing similar products for at least 5 years.
   2. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard.

B. Installer Qualification:
   1. Minimum of five years' experience installing access control, surveillance and security systems and devices.

2. After-sales support: The Contractor shall be a factory-authorized and trained dealer of the system and shall be factory-trained and certified to maintain/repair the system after system acceptance.

C. System Requirements:
1. All equipment, systems, and materials furnished and installed under this section shall be installed in accordance with the applicable standards of:
   a. National Codes: NEC, NFPA, BOCA, SBCCI, IBC, as applicable.
   b. Approvals and listings: UL, FM, ANSI SIA CP-01, CSFM, as applicable.
   c. Local Authorities Having Jurisdiction (AHJ).

D. Mock-Up: provide a mock-up for evaluation of installation techniques and application workmanship.
1. Finish system in areas designated by Architect.
2. Do not proceed with remaining work until workmanship and aesthetics are approved by Architect.
3. Remake mock-up area as required to produce acceptable work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers; and unharmed original identification labels.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect store materials from environmental and temperature conditions following manufacturer's instructions.

D. Handle and operate products and systems according to manufacturer's instructions.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. All components, parts, and assemblies supplied by the manufacturers and installed by the Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing upon date of acceptance by Owner. A qualified factory-trained service representative shall provide warranty service.

B. Service/Maintenance:
1. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).
2. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.
3. The installer shall correct any system defect within six hours of receipt of call from the Owner.
4. Extended service/maintenance agreements shall be offered by the Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly, or yearly.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Bosch Security Systems, Inc.; 130 Perinton Parkway; Fairport, NY 14450. ASD. Toll Free Tel: 800-289-0096. Tel: 585-223-4060. Email: request info (presales.support@us.bosch.com). Web: www.boschsecurity.us.

B. Substitutions: Not permitted.

2.2 GENERAL DESCRIPTION

A. Control Panel and Features:

1. The DACS control panel shall be Bosch Security Systems, Inc. model B9512G comprising a fully integrated intrusion and residential fire control system. The control panel shall support the following:
   a. Optional Telephone Line Module, programmable for signaling and supervision.
   b. Integrated Conettix IP based communication provides high-speed, secure alarm transport and control.
   c. 32 programmable areas with perimeter and interior partitioning.
   d. 8 on-board, hardwired points with expansion capability for a total of 599 using a combination of wired or wireless points.
   e. Compatibility with Color Graphic Touch Screen, 2-line alpha numeric capacitive touch
   f. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).
   g. The system shall include an integrated USB port for local programming and diagnostics using a computer running Remote Programming Software (RPS) and a male USB2.0 to male USB 2.0 cable with no additional hardware modules required.
   h. The system shall support the use of an Apple iOS device and/or Android device for control. Functions to include arming, disarming and control of outputs and access door, viewing of connected IP cameras. This application shall connect directly to the DACS using internet, Wi-Fi or cellular communications and shall not require a third party server of network operations center (noc).
   i. The DACS shall support up to thirty-two (32) custom functions allowing the installer to combine up to 6 functions into one command. These custom functions shall be operated by keypad command, point activation, key fob button, or programmable schedule
   j. The DACS shall support up to 32 keypad shortcuts which allow the installer to define which commands are available at each keypad.
   k. The system shall offer multiple language support that can be assigned per keypad. Languages supported must include English, Latin American Spanish, Portuguese and/or Canadian French.
   l. The DACS shall support flash firmware upgrades of systems firmware for the control panel and peripherals, allowing for future updates.
   m. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
   n. Provide 1.4 amps of power for standby operation and 2.0 amps of alarm power, both rated at 12 VDC.
   o. 3 configurable form ‘C’ wet or dry-contact relay outputs with expansion

capability for up to an additional 472 dry-contact relay outputs.

p. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.

q. Supervision of peripheral devices and communications interface(s).

B. Point Functionality and Expansion:

1. Each point in the system shall be programmable to provide the following type of response in the system:
   a. Always on (24 hour response).
   b. On when the system is Master Armed.
   c. Only on when the system is Perimeter Armed.
   d. Displays / Does Not Display at the ACC when the point is activated.
   e. Provides / Does Not Provide entry warning tone.
   f. Sounds / Does Not Sound audible alarm indication.
   g. The Point is bypassable / not bypassable.
   h. Alarm Verification with programmable verification time.
   i. Relay activation by Point.
   j. Provides / Does Not Provide "watch point" capability.
   k. Provides Swinger Bypass.
   l. Defers Bypass Report.
   m. Can return to the system after being force armed and then restoring.
   n. Can return to the system after being bypassed and then restoring.
   o. Keyswitch arming (maintained or momentary)
   p. Activate by Custom Function
   q. Activate following an output
2. The system shall support a programmable Monitor delay functionality for supervision of points during disarmed periods. These points may be programmed to ignore status from 1 to 60 minutes and will activate only if the point is off-normal for this time period.
3. The system shall support a programmable delay response functionality for supervision of points during armed or disarmed periods. These points may be programmed to ignore status from 1 to 60 minutes and will activate only if the point is off-normal for this time period.
4. The system shall support virtual points and outputs for customized programming of events
5. The DACS shall be capable of supporting "group zoning." Group zoning refers to the combining of points into a separately identifiable and separately annunciated (programmable text) areas.
6. The DACS shall be capable of allowing variable point response times via programming. Point response times shall be programmable over a range of 300 milliseconds to 4.5 seconds.
7. The DACS shall have the capability to expand up to 599 separately identifiable points, of which 8 are on-board and 472 are off-board wired, addressable or wireless points.
   a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
   b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.
   c. Addressable modules shall be able to be located remote to the panel to a maximum of 500 feet.
8. The DACS shall have the capability to expand up to 99 separately identifiable points, of which 8 are on-board and 91 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.
   a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.

b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.
c. Addressable modules shall be able to be located remote to the panel to a maximum of 500 feet.

C. Areas/Accounts:
1. The DACS shall support 32 independent areas. Each of the 32 areas shall have custom text associated with the armed state, disarmed state and point- off-normal state.
2. The DACS shall be capable of assigning 1 to 4 account identifiers to the areas depending on the distribution of areas per account.
3. The DACS shall be capable of assigning 1 to 2 account identifiers to the areas depending on the distribution of areas per account.
4. All of the areas must be capable of Master (All) and/or Perimeter (Part) arming (excluding predefined Interior protection).
5. The DACS shall be capable of logically grouping 1 or more points into an area, or conversely, dividing 2 or more points into two or more areas.
6. Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.
7. Areas shall be independently controlled by their corresponding ACC.
8. Area(s) shall accommodate assignment of independent account numbers to define annunciation, control, and reporting functions.
9. The DACS shall be capable of linking multiple areas to a shared area which may be automatically controlled (hallway or lobby).
10. The DACS shall accommodate conditional area arming dependent on the state of other areas (master or associate). Any area can be configured for perimeter and interior arming, not requiring a separate area for this function.

D. Output Relay Expansion: The DACS shall provide the capability for output relay expansion using relay expansion modules. Independent control of relay functions by area shall be possible through programming assignments.
1. The DACS shall be capable of activating 472 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module
2. The DACS shall be capable of controlling relays and automatically executing system functions based on a time / event scheduling program. The program can be hour, day of week or day of month based.
3. Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.
4. The DACS shall support 5 different types of alarm output selections: Steady, Pulsed, California Standard, Temporal Code 3 and Temporal Code 4.

E. Scheduling: The DACS shall support scheduling capabilities with the following characteristics:
1. Arm / Disarm specific area(s) based on open/close windows.
2. Bypass / Unbypass point(s).
3. Activate / Deactivate relay(s).
4. Send test reports.
5. Up to 4 programmable holiday schedules of 366 days each (includes leap year). Based on the holiday settings, different time windows for open/close and other system functions can be executed.
6. Automatic adjustment of system clock for daylight savings time.

F. Alarm Keypads:
1. The DACS shall accommodate connection with up to 32 ACCs, each capable of displaying custom English, Latin American Spanish, Portuguese or Canadian French text on a liquid crystal display.
2. The Alarm Keypads shall accommodate viewing and configuration of system parameters including:
   a. Network Parameters:
      1) DHCP Enable/Disable for the selected network module.
      2) UPnP Enable/Disable for the selected network module.
      3) IP Address for the selected network module
      4) Subnet Mask for the selected network module.
      5) Default Gateway for the selected network module.
      6) Port Number for the selected network module - The module's port number shall range from 0 to 65,535.
      7) DNS Server Address for the selected module's DNS server IP address
      8) DNS Host Name for the selected module. The DNS host name shall contain up to 63 characters.
      9) AES Encryption Key Size – Enable/Disable encryption by selecting the AES encryption key size for the selected network module.
      10) AES Encryption Key String - The user shall be able to display, add and modify the AES encryption string based upon the key size previously configured for the selected network module.

   b. Point Parameters:
      1) Point Selection between one and the maximum number of points in the control panel.
      2) Point Registration to allow system response from a specific physical point on any one of the expansion modules; On-board or Point expansion modules (wired or wireless)
      3) Wireless points shall be able to be enrolled in the system via an auto enrollment feature.

   c. Event Routing Parameters to allow programming of up to 4 report routing groups as well as configuration of primary and secondary paths.

G. User Passcodes and Authority: Passcodes shall be programmable with authority levels to allow users to operate any or all areas.
1. Up to 2000 different passcodes shall be accommodated
2. Each passcode shall be 3 to 6 digits (variable) and be assigned a 32-character user name
3. User access to System features and functions shall be configurable based on 14 individually programmable levels of authority assigned to the user passcode. Additionally, the system shall have the capability to assign to the user passcode, a different authority level in each of the areas. A service passcode can be assigned to the servicing agent allowing the agent limited access to system functions. User-programmable / activated functions include:
   a. Arming the system: All areas, specific area(s) only, perimeter instant, perimeter delayed, perimeter partial, watch mode, and arming the system with a duress passcode.
   b. Disarming the system: All areas, specific area(s) only and disarming with a duress passcode.
   c. Viewing system status: Faulted points, event memory, bypassed points, area status and point status.
   d. Implementation functions: Bypass a point, un-bypass a point, reset sensors, silence bell, activating relays, initiating the remote Programming function

locally to allow programming the system from a remote location.

e. Testing the system: Local Walk test, Service Walk test, Fire test, send report to remote DACR to check the telephone link, and programming the time and date for the next test report transmission.
f. Change system parameters: ACC display brightness, system time and date, and add/delete/change passcodes.
g. Extend the closing time of the system.
h. Transmitting special alerts and activating audible and visible signals.
i. Executing multiple commands / ACC keystrokes from a single Menu / Command List item. This function shall be able to have a 32 character (alphanumeric) title to identify it on the ACC display.
j. Editing of time / event based scheduling program from the ACC.
k. The DACS shall also provide a "service menu" to implement functions such as viewing and printing the system log, displaying the system firmware revision number, and defaulting (toggling) text displays between custom and default text displays for troubleshooting.

4. The DACS shall allow users to change their own user passcode from the Alarm Keypad (ACC). Managers shall be capable of changing the user passcodes and authority assignments by area of other users from the ACC.
5. The DACS shall incorporate a programmable "Passcode Follows Scope" feature to allow users to arm or disarm only the area they are entering with one simple command or control all areas from one ACC.

H. Communication: The DACS shall be capable of reporting system events and supervisory reports including alarm, trouble, missing modules, restorals, system status, AC failure, battery status to primary and secondary off-site DACR's. The following features shall be supported.

1. The DACS shall be capable of communicating via dial-up analog telephone lines, over a LAN/WAN/Internet using a wired network interface module, or over a cellular network using a CDMA Cellular interface module.
   a. Bosch B9152G Cell Kit as a secondary backup to access panel.
2. The Bosch Modem4 communications format shall be utilized for optimum system performance. The Modem4 format provides the maximum data information to the receiver for alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. The detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information. As an alternative format, Contact ID may be used although it will include less detailed information like point or user text.
3. The DACS shall be capable of sending text (SMS) messages to compatible devices without requiring that these message are sent to a monitoring center
4. The DACS shall have the capability of communicating with up to 8 different DACRs using up to 4 different phone numbers, up to 24-digits in length and/or 4 URL/IP addresses over a network.
5. The DACS shall report to a Commercial Central Station that is using a Bosch D6600 Receiver/Gateway or a Bosch D6100i Receiver using Modem4 as a preferred format or Contact ID as an alternate format.
6. The DACR shall provide the transmission information sent from the DACS that includes alarms, troubles, restorals, bypasses, relay activation, openings/closings, and card access. When using the ModemIIIa² format, the detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information.
7. The DACS reports shall be classified, by event, into eleven subcategories or "report groups." Each group represents similar types of events. Individual events within each group shall be selectively enabled or disabled for transmission. The eleven report groups shall be as follows:

a. Fire Reports.
b. Burglar Reports.
c. User Reports.
d. Test Reports.
e. Diagnostic Reports.
f. Relay Reports.
g. Auto Function Reports.
h. RPS Reports.
i. Point Reports.
j. User Change Reports.
k. Access Reports.

8. The DACS shall have the capability to verify the integrity of the remote communications path and switch to alternate paths when a communications failure occurs.
9. The DACS shall be capable of unattended mode of operation whereby programming and configuration updates are automatically transferred using the Remote Programming Software (RPS). These updates can initiate from either the control panel or the remote computer using RPS.

I. Network Communication: The DACS shall be capable of network communications over a LAN, WAN, Intranet, or the Internet. The system shall include supervision of the network communication utilizing configurable periodic heartbeats to the Digital Alarm Communications Receiver (DACR). The DACR shall provide notification of the loss of communications from a networked system after a programmable timeframe since the last communication. The notification options shall be programmable and include local annunciation or indication to automation software.

1. The network interface module shall be capable of supporting Dynamic Host Communication Protocol (DHCP) to obtain an IP Address.

2. The system shall support a method of authentication between the control panel and the receiver to ensure that the control panel has not been compromised or replaced.
3. The network interface modules shall be capable of supporting encryption using a minimum of 256-bit AES Encryption (Rijndael) certified by NIST (National Institute of Standards and Technology) utilizing the Cipher Block Chaining (CBC) method.
4. The network interface module shall support a 10/100BaseT connection to an Ethernet network.
5. The control panel shall be capable of network communication with a programmable poll time to send periodic heartbeats to the receiver, programmable ACK Wait time, and programmable retry time. In the situation where a communication path is unsuccessful, the control panel shall be capable of attempting backup communication through an available communication method to the same receiver or a backup receiver.
    a. The control panel shall have the ability to automatically adjust the heartbeat rate of a backup path that is using cellular to the heartbeat rate of the primary path in case of a primary path failure. Upon restoral of the primary path, the heartbeat rate of the backup path shall automatically restore to the original rate. This allows a system utilizing cellular communications to keep the wireless charges low.
    b. The network communication between the control panel and the receiver shall use Modem4 or Contact ID.
    c. The control panel shall be capable of two-way communication using a wired network interface module with a 10/100BaseT on a LAN/WAN/Internet configuration or with a cellular module on the Internet.

d. The control panel shall be capable of configuring the destination of the receiver using a URL or static IP Address.
e. The control panel shall be capable of using DNS to lookup the IP Address of the receiver when programmed with a URL.
f. The control panel shall support UPnP for automated Port Forward configuration in the router where the control panel is installed.
g. The control panel shall support AutoIP to enable the RPS software to connect to the control panel locally using an IP Direct connection.
h. The control panel shall support configuration of the IP parameters from the keypad eliminating the need for a PC to configure the IP device.
i. The control panel shall support network diagnostics from a keypad to allow local testing of network connectivity. The diagnostics should include, Ethernet cable connected, gateway configuration ok, DNS lookup operational, and external network connectivity (such as the Internet) operational.
j. The system shall be capable of meeting DCID 6/9 and UL 2050 standards.

J. Event Log: The DACS shall maintain a log of events indicating time, day, month, year type of event, account number, area number, user ID, point text, user text and primary/secondary event route. The system shall allow the following characteristics:
1. The DACS shall be capable of storing up to 10,000 events
2. The DACS shall support viewing of logs locally at the ACC and remotely via an upload to a remote central station computer running the RPS software.
3. The DACS shall provide notification via a report to the DACR when the event log reaches a programmable “percent full capacity". This allows retrieval of stored events via RPS to prevent any loss of event history.
4. Group, signal type and area can route events to specific receivers.
5. Each DACR shall be designated as a primary, backup, or duplicate destination for each report group. Assigning an event to multiple routing groups provides for duplicate destinations for the event. The transmission of grouped events allows the reporting of different types of information to different remote DACRs.

K. Testing, Diagnostic, and Programming Facilities: The DACS shall be capable of sending (manually or automatically) test and status reports to remote DACRs.
1. The DACS shall be capable of sending automatic tests daily, weekly or once every 28 days. Automatic test times shall be programmable to provide an offset of up to 24 hours from the current time.
2. Automatic test reports shall be programmable to be deferred by one test interval if any other report is transmitted in the current interval.
3. Automatic test reports and remote system access for diagnostics shall be supported via a remote central station computer with Remote Programming Software (RPS).
4. The DACS shall be programmable locally or remotely. Programming shall be accomplished via a Keypad or a computer with a remote programmer and diagnostic software package (RPS).
5. The DACS shall allow an on-site user to initiate remote programming while on-line with the servicing location. The remote programming device must provide a compare feature and allow for downloading either the stored program or the (un)modified program copied from the panel.
6. The DACS shall allow the local programming option to be disabled and must provide a method to program a panel while no one is on premises, when the panel shares a line with an answering machine.
7. The DACS shall accommodate IP Diagnostic to verify settings and operation of the network interface modules; Host name, MAC address, IPV4 address assignment.

The IP Connection test shall include; Link test to verify physical cable integrity, Ping test to verify gateway response, ping test to verify address on the internet.

8. Wireless point diagnostics shall include signal strength and device states of registered wireless points in the system.
9. The number of system testing and programming sessions shall be restricted via the use of program locking features and passwords. Passcode protection in excess of sixteen million combinations is required.
10. New modules support enhanced diagnostics through RPS

L. Miscellaneous Features: Programmable alarm output timer, 4 programmable entry delay times, exit delay programmable by area, individually programmable point of protection text, point bypassing, key switch arming capability with LED outputs, and fire verification.

M. False Alarm Reduction: The DACS shall comply with all ANSI SIA CP-01 2010 requirements for false alarm reduction

N. Ambush Detection: The DACS shall include an early ambush feature that requires that the user disarm, and then inspect the facility within a specified time period, before entering their passcode or a different authorized passcode again. If the user does not enter a passcode a second time, a duress event is generated. If the user does enter a passcode within the specified time period, the system disarms.

O. Two-man rule: The DACS shall include a programmable feature that requires 2 separate passcodes to be entered to disarm the system. After 1 passcode is entered, the system will prompt for a second passcode to be entered on the same ACC. Without the second passcode, the system shall not disarm.

P. Dual Authentication: The DACS shall support Dual Authentication by area. Areas programmed for Dual Authentication require activate of a card and a passcode to allow access to system functions, arm/disarm, or access control doors.

Q. Area Re-Arm: The System shall support programmable area re-arm time of 1 minute to 24 hour.

R. User-Programmable Features: The DACS shall provide a menu driven interface to provide a user-friendly command structure for programming / customizing the system to the operational criteria of the application. The DACS shall be capable of being operated via:

1. The Command Structure.
2. Menu / Command List.

2.3 SYSTEM INTERFACE REQUIREMENTS

A. Grounding: The Contractor shall properly earth ground the DACS to prevent electrostatic charges and other transient electrical surges from damaging the DACS panel.

B. Primary power: The Contractor shall provide a dedicated 120 VAC power circuit to the DACS system. This circuit shall be connected to the emergency power system. The 120 VAC is stepped down to power the DACS panel using a class two, plug-in transformer. This power circuit shall be properly rated to continuously power all points and functions indefinitely in full alarm condition.

C. Primary power supervision: When the primary power source fails, the system can be configured to report an "AC Fail" message to a commercial central station.

1. The message can also be programmed to "tag-along" with another message

transmitted to the central station.

2. The system will always display a loss of primary power on the ACC and may be configured to provide additional audible warning.
3. The transmission delay of this message is programmable from 5 seconds to 86 minutes with an optional 6 to 12 hour transmission delay

D. Secondary power (standby battery): The Contractor shall provide adequate battery power as defined by the relevant application criteria, (UL 864 and UL 985 for alarm installations or NFPA 72 chapters for fire applications). Appropriate battery chargers shall be provided consistent with the battery back-up capacity. The most current accepted version of NFPA 72 and any applicable local codes or AHJ requirements must be met accordingly.

E. Secondary power supervision: When the secondary power source experiences a 85 percent depletion of its standby capacity, the system can be configured to report a "Low Battery" message to a commercial central station. The system will always display a low battery condition on the ACC and may be configured to provide additional audible warning.

F. Telephone interface: The control panel in the DACS shall be equipped with an optional phone line monitor and shall interface with the phone lines via RJ-31X jacks for supervision of the telephone line connection.

1. The telephone line interface shall conform to FCC rules (Title 47 C.F.R. part 68).
2. When a telephone line is determined to be out of service by the DACS panel, the event will be annunciated locally on the ACC and transmitted to the central station over the alternate communications interface. The transmission delay of this message is programmable from ten to two-hundred forty seconds.

G. Ethernet Interface: The DACS shall include an integrated Ethernet interface module as the primary, or back-up means of communicating to a DACR.

1. Built-in IP-based alarm transport, programming, and control
2. The module shall accommodate 128 and 256-bit AES encryption using CBC (Cipher Block Chaining) mode.
3. 10BASE T or 100BASE T network connection
4. Full-duplex and half-duplex support

H. Cellular interface: The DACS may use a cellular radio module as the backup means of communicating to a DACR. Up to 4 IP Addresses shall be available for routing system events. The supervision time shall be programmable with a range of 5 to 65,535 seconds. The module shall accommodate 128 and 256-bit AES encryption using CBC (Cipher Block Chaining) mode.

I. Auxiliary function control interfaces: The DACS shall accommodate auxiliary functions such as activating bells, strobes, or lights and shall be accomplished using the optional application specific relay modules. These auxiliary interfaces shall be electrically isolated to avoid inter-system interferences or damage to the system.

J. Wiring: The contractor shall provide cables consistent with the manufacturer's recommendations. The following general guidelines shall be followed for wiring installation:

1. Wiring shall be appropriately color-coded with permanent wire markers. Copper conductors shall be used.
2. All signal cables provided under this contract shall be Class II, plenum-rated cable where required. Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.

3. Data wires shall not be enclosed in conduit or raceways containing AC power wires.
4. Where EMI may interfere with the proper operation of the DACS circuits, twisted/shielded cable shall be used.

K. Environmental Conditions: The DACS shall be designed to meet the following environmental conditions:
1. The system shall be designed for a storage temperature of -10° C to 70°C (14° F to 158°F).
2. The system shall be designed for an operating temperature of 0° C to 50°C (32° F to 120°F).
3. The system shall be designed for normal operation in an 85% relative humidity environment.
4. The system shall meet or exceed the requirements of FCC rules Title 47 C.F.R. Part 15, Class B devices, and Part 68, IEC EMC directive

2.4 ACCESSORIES

A. System Accessories:
1. B520 Auxiliary Power Supply Module, 2A 12V
2. B208 SDI2 8-Input Expansion Module
3. B303 SDI2 8-Output Expansion Module
4. D122L Dual Battery Harness, 35” 12V
5. D1218 12V 18Ah Battery (minimum of 2)
6. D137 Accessory Mounting Bracket
7. D101 Enclosure Lock and Key Set (provide 5 sets of additional keys per enclosure)
8. D110 Tamper Switch (provide 1 for each security enclosure on the project, including power supplies)
9. D8108A Attack Resistant Enclosure
10. D804 Transformer Enclosure Kit (one for each, security associated, wall plug transformer on the entire project)

2.5 FIELD DEVICES

A. Keypads:
1. Keypad shall feature an illuminated touch screen and graphical interface. Each keypad shall have user adjustable options such as volume and brightness show system messages for all areas.
2. The touch screen display shall use icons, words, numbers, and symbols to show the status of the security system and for interacting with the security system. When several events occur, the keypad shall show each event in order of priority.
3. The keypad shall detect when a user approaches and automatically activate the display.
4. The keypad shall be white in color
   a. Approved Product
      1. Bosch Product No. B942 Touch Screen Keypad.

B. Motion Detectors:
1. Detector Requirements
   a. Detectors shall be a PIR/microwave detector unit incorporating range adaptive Doppler radar and PIR signals into an intelligent algorithm to provide accurate and reliable alarm decisions.
   b. Detectors shall be built with a sealed optic chamber to provide immunity to drafts, insects, and small animals.
   c. Detectors shall be designed to provide coverage in the event the microwave

subsystem fails.

d. A Multi-Point Anti-mask with Integrated Spray Detection system shall send a supervision trouble signal if a masking material is placed within 30 cm (1 ft.) of the detector.
e. Detectors shall contain light emitting diodes (LEDs) that adjust automatically to the surrounding light level. A blue LED indicates dual alarms and activates during a remote walk test. The walk test LED may be enabled or disabled from the control panel or locally at the detector via a DIP switch. A yellow LED shall indicate microwave alarms, and a red LED indicates PIR alarms.
f. Detectors shall provide a remote self-test function that initiates when the walk test input switches to its active state. The alarm relay and alarm LED activate for four seconds following a successful test. The trouble relay activates and the alarm LED flashes following a failed test.
g. Detectors shall provide input power supervision that activates the trouble relay and causes the LED to flash when the power is lower than 8 volts.
h. Each motion detector shall have an individually dedicated POPIT

2. Sensor Technology
   a. The detector shall incorporate sensor data fusion technology that uses an internal microprocessor to gather, analyze, and compare the data from five separate sensors to make the most intelligent alarm decisions. The data processed from the microprocessor shall be from two pyroelectric sensors, a Doppler microwave sensor, a room temperature sensor, and a light level sensor.
   b. The detector shall also incorporate tri-focus technology that uses three high-quality Fresnel lenses with three specific focal lengths to provide long-range, middle-range, and short-range coverage. The detector shall apply the three focal lengths to 86 detection zones which combine to produce 11 solid curtains of detection. The tri-focal optics technology shall include two pyroelectric sensors which deliver twice the standard optical gain.
   c. The detector shall provide active white light suppression capable of measuring the light intensity directed at the face of the unit, and use the data gathered by the sensors to eliminate false alarms caused by the bright light source. False alarms shall not be caused from bright light sources up to 10,000 lux.
   d. The detector shall provide dynamic temperature compensation that adjusts the PIR sensitivity to detect human body heat accurately to avoid false alarms and deliver consistent catch performance at all operating temperatures.
   e. The detector shall provide multi-point anti-mask with integrated spray detection, utilizing patented prism lenses and active infrared detection to provide industry-leading protection against all known forms of attack.

3. Approved Products
   a. Wall Mount Motion Detector: Bosch Product No. ISC-PDL1-WA18GB
   b. Wall Mount Curtain Motion Detector: Bosch Product No. ISC-PDL1-WAC30G
   c. Ceiling Mount Motion Detector: Bosch Product No. DS9370

C. Magnetic Door/Hatch Contacts:
   1. Recessed Steel Door Contacts: Interlogix Product No. 1076D-G Double Pole Double Throw
   2. Surface Mount Contacts (provide and roof hatches, gates, and any location requiring surface mounting): Bosch Product No. 2507AD-L Double Pole Double Throw
   3. Overhead Door Contacts Double Pole Double Throw: Sentrol Product no.

2317A or 2327A (coordinate correct contact with door channel)

4. Do not combine multiple doors onto a single POPIT. Each single and double door shall be on an individual POPIT.

D. Sounder/Strobe Annunciation Devices - Contractor shall add an in ceiling sounder, at each exterior door location and tie back to access control system. System shall be configured to activate sounder after door has been ajar for a given time period, configurable by system settings. Sounder shall silence after door is closed and door contact closure has been initiated. Install sounder in standard electrical back box no higher than 18" above ceiling. Route wiring from sounder back to access control system and required power supplies at headend location.
   1. Schneider Electric LED Unit - SQD-XVUC29
   2. Schneider Electric Sounder Unit - SQD-XVUC9S
   3. Schneider Electric Fixing Unit SQD-XVUZ0

E. Security RF Wireless
   1. Provide and install an RF Wireless System as shown on the project drawings. The Integrator shall conduct a wireless survey prior to deployment. The system shall consist of the following Gateways, Repeaters, and transmitters:
      a. Wireless Serial Receiver Kit consisting of an EN4200 serial receiver and a Bosch B802 interface board: Inovonics Product Number ENKIT- SDI2. Locate receiver at Intrusion Control Panel Location.
      b. High Power Repeater: Inovonics Product No. EN5040
      c. Pendant Transmitter: Inovonics Product No. EN1223S (quantity of 10)

F. Panic/Duress Buttons
   1. Wall Mount Buttons: STI Product No. UB-1
   2. Under Counter Buttons: USP Product No. HUB3B

G. Miscellaneous Devices:
   1. POPIT Modules with Tamper: Bosch Product No. D9127T

2.6 WIRING

A. All wiring shall be by the manufactures specifications. All cable shall be shielded as required.

B. All 120v Power shall be furnished by the Division 26 contractor.

C. All Security Conduit as show on the drawings shall be furnished by the division 26 contractor as part of their scope of work.

D. Coordination with the Division 26 contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.

E. All systems shall be connected to an emergency power source as available.

F. Color code of all security intrusion detection system and access control wiring shall be purple in color.
   Approved Products:
   1. 18/2 unshielded: Belden Product No. 6300UE or equivalent
   2. 18/2 shielded: Belden Product No. 6300FE or equivalent
   3. 18/4 unshielded: Belden Product No. 6302UE or equivalent
   4. 18/4 shielded: Belden Product No. 6302FE or equivalent

PART 3 EXECUTION

3.1 INSTALLATION

A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings

B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire maybe run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article760 if so approved by the local authority having jurisdiction.

C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit “fill” not to exceed 40% per NEC.

E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations such as inside walls, all mechanical / electrical rooms, or other areas where wiring might be exposed or subject to Damage.

G. All vertical wiring and all main trunk / riser wiring shall be installed in a complete raceway / conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

H. Provide a Green 4 pair Comm scope Category 6a telephone cable from the Master Control Panel to the Telephone Equipment room.

I. 2 18-4 wires will be run from the panel to the prior designated future portable connection location and labeled in plain English on both ends. These spares are to be left above the ceiling.

J. Each set of magnetic door contacts or glassbreaks that protect one room are to be connected through one POPIT module for point identification of that room.

K. Magnetic door contacts protecting separate hallways or entries are to be connected into separate POPIT modules for separate identification.

L. Provide and install (1) dedicated POPIT for each device installed on the project including but, not limited to glass break detectors.

M. All POPIT Modules shall be installed inside a 4”x4” junction box with a cover to be mounted on the wall nearest to the device the POPIT Module is associated with. All boxes shall be labeled with the appropriate corresponding point contained within.

N. Integrate the security system to the remote monitoring station. Provide all hardware and cabling as required. Coordinate with Owner for approved remote monitoring service.

O. All POPIT modules on project shall be mounted above ceiling in easily accessible area.

P. All keypads, sirens and POPEX modules shall have dedicated homeruns from each

device to the master control panel. Do not daisy chain keypads or sirens. Chaining of modules is permitted if location serves multiple areas of coverage.

Q. All POPIT modules and power supplies are required to be located on as-built drawings delivered to owner at substantial completion of project.

R. Contractor shall install communication wire from freezer/cooler control panels to burglar alarm via POPIT module interface to notify panel should freezer/cooler encounter high temperature condition. Coordinate programming and final terminations with Owner.

S. All POPEX modules and power supplies shall be installed in IDF closets for that area of coverage with easy accessibility and a dedicated SDI2 homerun to the master control panel not to exceed 500ft.

T. All device power runs shall be fused and clearly labeled in plain English at each main power source.

3.2 EXAMINATION

A. Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.

B. Do not begin installation until unacceptable conditions are corrected.

C. If preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

D. Ensure selected location is secure and offers protection from accidental damage.

E. Location shall provide reasonable temperature and humidity conditions, free from sources of electrical and electromagnetic interference.

F. Ensure power source is protected against accidental shutoff.

G. Install all equipment and materials in accordance with the "current" recommendations of the manufacturer. The work shall also be in accordance with:
1. Installation criteria defined in these specifications and in the construction documents.
2. Factory Representative can be the Bosch Security Systems Inc. Security Dealer.
3. Approved submittals.
4. Applicable requirements of referenced standards.

H. The contractor shall provide the following services as part of the contract:
1. Supervision of sub-contractors.
2. Coordination of other contractors for system-related work (electrical contractor, finish hardware contractor, architect, and general contractor).
3. Attending site construction/coordination meetings.
4. Keeping updated construction drawings at the construction site.
5. Meeting construction deadlines per the construction schedule.

I. Programming of the system shall include the following tasks:
1. Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters).
2. Programming operational parameters such as opening/closing reports and windows, system response text (custom English) displays of events, activation of relays that

drive auxiliary devices, and identifying types of zones/loops.

3. Programming passcodes according to the authorities and functions defined by the owner.
4. Other system programming tasks required by the owner. These additional programming requirements shall be coordinated between the owner and the contractor.
5. Operational Testing: The contractor shall perform thorough operational testing and verify that all system components are fully operational.
6. Hard-copy System Printout: The contractor shall submit a hard-copy system printout of all components tested and certify 100 percent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.
7. Acceptance Test Plan Form: An acceptance test plan form shall be prepared/provided by the contractor prior to the acceptance walk-through.
8. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording findings during the walk- through.
9. Fire Alarm Systems shall comply with NFPA 72 Standards for inspection, testing, and maintenance.

J. The contractor shall certify completion in writing and schedule the commissioning walk-through. The contractor shall provide all the tools and personnel needed to conduct an efficient commissioning process.

3.3 FIELD QUALITY CONTROL

A. Installation contractor shall submit a written test report that the system has been 100 percent tested and approved. Final test shall be witnessed by the owner, engineer, electrical contractor, chief security officer, and performed by the installation contractor. Final test report shall be received and acknowledged by the owner prior to request for final payment.

B. Provide instruction to the owner's satisfaction with regard to proper use and operation of the system.

C. Determine and report all problems to the manufacturer's customer service department.

3.4 ADJUSTING

A. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).

B. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices, and the telephone lines.

C. The installer shall correct any system defect within six hours of receipt of call from the Owner.

3.5 DEMONSTRATION

A. Demonstrate at final inspection that surveillance system and devices functions properly.
   1. The Contractor upon completion of installation shall furnish training in the complete operation of the systems.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION 28 16 00

SECTION 28 23 00 - IP SECURITY CAMERA SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all required materials to expand the existing IP based digital video surveillance system. Contractor shall include cameras, cabling, digital image storage, integration and accessibility with Owner's Local/Wide Area Network (LAN/WAN), Internet accessibility thru remote view application software and simultaneous user access capability as required. Provide fully terminated unshielded twisted pair (UTP) cable, UTP terminations, racks, raceways, conduit, and other incidental and miscellaneous premises wiring system hardware as required for a complete and useable system. The installation shall comply with applicable codes and standards in effect at the job site and as indicated in the Specifications and Drawings. Reference technical cabling specifications for cabling requirements. **This scope of work shall be carried in an Allowance.**

B. Provide all electronic hardware and coordinate with the building's LAN/WAN. The contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.

C. Contractor must be a current integrator of solution in the nearest, major metropolitan marketplace and be able to include information on current support staff to be able to service this client.

D. Contractor is responsible for coordinating all electrical work required on this project for connection of servers, cameras, conduit, and power supplies. Contractor shall provide a complete turnkey solution to the owner and be responsible for the complete installation of a security camera system at each campus.

E. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE THE LICENSING AND REGISTRATION FOR ALL EQUIPMENT INSTALLED ON THIS PROJECT.

1.2 OVERVIEW:

A. Work to include installation of IP addressable video surveillance and provide the capability of connection to access monitoring control systems within the facility. Connection to the data network system is required. Coverage is to be interior as well as designated exterior areas indicated on the plans.

1.3 VIDEO SURVEILLANCE SYSTEM

A. The Building Surveillance System will be used to monitor selected interior and exterior areas at all times.

B. The system is used to visually monitor designated areas as indicated on the plans.

C. The following functional capabilities are considered essential for this Surveillance system.

i. Switch any assigned camera in the system to any monitor in the system.
ii. Provide partitioning of cameras and priority access
iii. Cameras equipped with environmental housings.
iv. Provide fused low voltage power for control of heater and blower.
v. Adjust and balance cameras via software from network accessed workstations.
vi. Minimum camera adjustments available:

- Iris
- Shutter
- Zoom
- Focus
- Gain
- Hue
- Backlight Compression
- Color Saturation
- Brightness
- Aperture
- Contrast

D. Enter and edit video information on-line and save them for future use.
E. View via multiple monitors at once.
F. Define the sequence for viewing camera(s) on each monitor.
G. Bypass cameras in the system during sequencing to a monitor.
H. Provide the capability to program alarms and associated incoming alarms with related outputs.
I. Bypass alarms in the system, either by position or time deactivation.
J. Provide time/date and alphanumeric camera titling.
K. Provide real time system status in the master controller.
L. Provide IP addresses coordinated with the districts telecommunications department.
M. Connect to the access control system to recall of presets.
N. Record alarmed and monitored camera viewing areas.
O. Cameras must be able to be set for motion detection modes.
P. Camera data cabling is already installed as part of base construction project and is not required for this project. Contractor is still required to install low voltage power supplies and low voltage power to enclosures as required for exterior cameras and housings.

1.4 DEVELOPMENT OF GRAPHICAL USER INTERFACE (GUI) AND SOFTWARE CONTROL:

A. Control and configuration must offer integration of components and operation into one complete system. Cameras and software components within the system must be from the same manufacturer unless otherwise noted.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. The Video Surveillance System Installer shall be licensed and shall meet all applicable regulations. The Contractor shall be a firm normally employed in the low voltage and video cabling industry.
2. The contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor

shall furnish with their submittal a letter from the manufacture indicating they are a dealer in good standing.

3. The contractor must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.
4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
5. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
   a. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
   b. A list of test equipment proposed for use in verifying the installed integrity of metallic cable systems on this project.
   c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.
   d. A list of technical product training attended by the contractor's personnel that shall install the video surveillance system shall be submitted.
   e. Any subcontractor who shall assist the video surveillance contractor in performance of this work shall have the same training and certification as the video surveillance contractor.

B. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.6 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Local Building Code
2. Local Electrical Code
3. NEC National Electrical Code

B. Other references:

1.	TIA/EIA-568-A -	Commercial Building Telecommunications Wiring Standard
2.	EIA/TIA-569 -	Commercial Building Standard for Telecommunications Pathways and Spaces.
3.	TIA/EIA-606 -	The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4.	TIA/EIA-607 -	Commercial Building Grounding and Bonding Requirements for Telecommunications
5.	TIA/EIA TSB 67 -	Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
6.	ISO/IEC 11801 -	Generic Cabling Standard
7.	EN 50173 -	Generic Cabling Standards for Customer Premises

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.7 SUBMITTALS

A. The video surveillance system installer shall furnish all CCTV system submittals in a single consolidated submittal

B. Shop Drawings: Submit the following items, for Owner review and approval:
1. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
2. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer
3. Product Literature: Complete manufacturer's product literature for all electronics, cable, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Architect/Engineer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
4. Testing: Proposed Contractor test result forms, a list of instrumentation to be used for systems testing.
5. A complete point-to-point floor plan diagram indicating camera locations and all required cabling to connect systems.

C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
3. All training sessions with district staff and training media shall be complete.
4. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. The as-built drawings shall be prepared using AutoCad V. 13 or later. Provide the Owner with electronic versions of the as-builts on 2 qty. 8MB thumb drives.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the specifications. All approved equivalent products shall be published by addendum ten days prior to proposal for Architect/Engineer review.

C. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.

D. All systems and components shall have been thoroughly tested and proven in actual use.

E. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.

F. All systems and components shall be provided with an explicit manufacturer warranty.

2.2 CAMERAS

A. *Camera Environmental Housing Power Supply:*

1. Provided for powering of camera environmental housings.
2. Power supplies mounted in IDF or MDF.
3. Route cable from camera to nearest power supply unit.
4. PoE customer provided.
5. All gymnasium cameras shall be wall mounted unless otherwise noted. Provide clear, polycarbonate protective cover.
6. All exterior cameras shall be wall mounted unless otherwise noted.

2.3 ACCEPTABLE PRODUCT:

A. **Approved product: AXIS only. For any camera types EOL or discontinued, contractor must provide equivalent or better models along with an approved substitution document for owner's approval, prior to construction.**

1. Provide as shown on drawings.
2. Provide all requisite back boxes, mounting brackets, pendant kits, bracket wall accessories and IP51 rated drop ceiling kits.
    a. TYPE 1 – P3265-V - Interior 2MP single sensor camera
        i. Wall / Ceiling mount
        ii. Main entrance foyer*
        iii. Kitchen back door, etc.
    b. TYPE 2 – Q3819-PVE - Interior / Exterior 14 MP panoramic seamless 180° camera:
        i. Wall mount
        ii. Gymnasiums – minimum of two opposite each other, centrally located length of gymnasium.
        iii. Parking lot overview***
    c. TYPE 3 – P3737-PLE - Interior / Exterior 15 MP multi-sensor 360° camera
        i. Ceiling / Wall / Corner mount
        ii. Intersection of 3 or more corridors*
        iii. Library – 2 minimum*
        iv. Cafeteria – 3 minimum*
        v. Exterior walkways / Bus ramps
        vi. Exterior building corners***
        vii. Athletics press box – 2 minimum, FOV – Bleachers / rear of press box
        viii. Concessions stands – 2 minimum, FOV – General area and walkways**
    d. TYPE 4 – M4327-P - Interior 6MP single sensor 360° camera
        i. Ceiling mount
        ii. Install above Cafeteria POS
        iii. Kitchen Manager's Office, FOV - Safe
        iv. Stage (Elementary Schools only).
    e. TYPE 5 – P3267-LV - Interior 5MP single sensor camera with IR: P3267-LV
        i. Wall / Ceiling mount

ii. Stairwells**
iii. Short corridors, FOV – entry / exit doors

f. TYPE 6 – P4707-PLVE - Interior / Exterior 2x5MP dual-sensor with 360° IR
i. Ceiling / Wall mount*
ii. Admin Office
iii. Stariwells**
iv. Centrally located in long corridors
v. Corner of “L” shaped joining corridors
vi. Kitchen corridors

g. TYPE 7 – P3818-PVE - Interior / Exterior 13MP single sensor seamless 180° camera
i. Center of wall in large open areas***
ii. Bus ramps, viewing parking lots, mounted on canopies.

* - Subject to interior ceiling height (10’-12’ maximum installation height).
** - Subject to complexity of FOV
*** - 12’ minimum mounting height (subject to FOV of adjacent canopies)
FOV = Field Of View

B. Model numbers and manufacturers included in this specification are listed to establish a standard of product quality and the desired standards for District facilities. It is the responsibility of the installation contractor to coordinate with telecommunications cabling and district network providers for the correct cabling and hardware requirements of the equipment being provided.

2.4 BUILDING SURVEILLANCE OUTDOOR ENVIRONMENTAL CAMERA HOUSING:

A. Provide a weather resistant Nema 4X rated enclosure construction of aluminum bracket, acrylic and UV stable plastic.

B. Internal dimensions: accommodate camera, lens and serving cables.

C. Provide with thermostatic controlled blower and heater.

D. Provide UV protection rating UL flame rating of 94V0.

E. Provide weatherizing mounting as required for network cable entry and connection to maintain network 6 classification,

2.5 Video Management System:

A. The contractor shall provide programming and licenses to add all new cameras shown to the existing XProtect Milestone Enterprise video management System.

B. Provide Milestone XProtect Camera License for each camera installed.

C. Provide a one (1) year milestone software upgrade plan for cameras and base server.

2.6 DATA CLOSET (MDF/IDF) TERMINATION HARDWARE

A. Contractor will be responsible for coordinating with District technology department on acquiring any network configuration information such as IP numbers that will be required to connect servers to district network.

B. Contractor is responsible to provide network cabling connection, either fiber or category 6, to owner provided network equipment. This connection allows recording unit to be connected to owner’s local area network.

2.7 CABLE AND INSTALLATION

A. Contractor to provide all penetrations and all conduits as necessary for installation of CCTV installation.

B. All exterior penetrations require necessary weatherproofing to avoid moisture penetration.

C. All outdoor cable runs underground shall be rated for underground use.

D. Coordinate all power circuits required for the servers and camera power supplies.

E. Contractor shall not run any power cabling for any security equipment on rack tray system due to EMI considerations. Contractor shall provide individual cabling support for all low voltage power cabling.

F. All cabling for entire project shall be installed in conduit for the entire run. No exceptions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable Pathway:
   1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 25 cables or less, with cable ties snug, but not deforming the cable geometry. Cable bundles shall be supported via “J” hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Plenum rated cable ties shall be used in all appropriate areas. The Contractor shall adhere to the manufacturer’s requirements for bending radius and pulling tension of all cables.
   2. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
   3. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

B. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

C. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.

D. Provide three sided pre-finished metal hood and seal to wall where conduit penetrates exterior wall.

E. Install new conduit on portable pipe supports – (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.

F. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top and sides (not bottom)

3.2 EQUIPMENT RACK CONFIGURATION

Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

3.3 WIRING INSTALLATION

A. General:
   1. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
   2. All cable must be handled with care during installation so as not to change performance specifications.

B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cable shall only be run where indicated on the Drawings. Additional exposed cable runs shall require Owner approval, and shall only be allowed when no other options exist. Cabling shall be installed concealed at all times, except in unfinished mechanical rooms or wiring closets where cable shall be installed exposed and located to avoid conflicts with pass-through cabling, etc. Tie wraps shall be used to provide a neat appearance. Provide “D” rings or the appropriate cable guides to dress the cable.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner’s efficient use of their full capacity.

Cable Routes: All cabling placed in ceiling areas must be in conduit, cable tray, or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Caddy CAT 21 or CAT 32 hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable individually supported support loops on 5’ on center maximum centers to hang cable. Cable shall be routed so as to provide a minimum of 18” spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be banded together every 6 feet.

3.4 DOCUMENTATION

A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8”) in height, block. All labels shall correspond to as-builts and to final test reports.

D. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner’s labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic

coated) on all cables and outlets.

C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.

D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.5 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS

A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.6 INSPECTION

A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Architect/Engineer may observe before acceptance.

3.7 WARRANTY

A Guarantee and warrant all equipment provided for a period of **3 years** following date of substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration.

B. All such warranties shall include all parts (Cameras, encoders, power supplies, housings, etc.).

C. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion.

END OF SECTION

28 31 00 - FIRE DETECTION AND ALARM SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1. DESCRIPTION:

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

D. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

E. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

F. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

G. The contractor shall field verify all existing device locations and remove them in their entirety including cable. No abandoned cable will be allowed. No cable shall be reused during the installation of the new devices.

H. The contractor shall field verify all AHU equipment and provide a Duct Detector for each unit over 2000 CFM. There is an approximate number of 20 Air handlers in the school that will require a duct detector to be installed. The contractor shall provide the devices and installation of these devices in the base proposal.

I. System shall have a minimum of two loops. Contractor shall not load any loop greater than 75% of its detector loading capacity to allow for future expansion.

J. The contractor shall provide and install new devices in the existing portable buildings. Refer to drawings for approximate portable building locations.

K. Only basic equipment devices have been shown on the contract drawings. Specific wiring between equipment/devices may not be shown. It is the contractor's responsibility to submit for approval the COMPLETE ENGINEERED system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein to provide a complete operational system as specified.

L. The drawings show basic device placement to set design criteria. It is the installing contactors responsibility to provide a complete and functional system that meets all applicable codes. The contractor shall include additional devices as required to the design shown to ensure voice evacuation announcement volume levels are met as well as Visual device lumen outputs are reach acceptable levels.

1.2. SCOPE:

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings to provide a complete smoke detection and fire alarm notification including voice evacuation capabilities.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

4. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
6. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone whichever is greater.
7. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
8. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
9. Two-way telephone communication circuits shall be supervised for open and short circuit conditions.

C. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the system display shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

1.3. SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.

3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.

E. Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.4. GUARANTY:

All work performed and all material and equipment furnished under this contract shall be free from

defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5. Contractor Qualifications:

A. The installing contractor shall be the authorized representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the fire alarm manufacturer's product for at least two years.

B. The installing contractor shall be licensed by the State Fire Marshall to sell, install, and service fire alarm systems as required by Article 5.43-2 of the Texas Insurance Code.

C. The installing contractor shall have on his staff an installation technician licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the Texas Insurance Code.

D. The installing contractor or equipment supplier shall have on staff a minimum of two (2) certified NICET Level III state licensed fire alarm planning superintendents under whose supervision system design shall take place. In lieu of an alarm planning superintendent, the contractor may provide design supervision by a registered professional engineer.

E. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.

F. **The installing contractor must have a permanent office within a 75 mile radius of the project site and be an approved dealer/integrator, of the proposed system, in the nearest major metropolitan area.**

G. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems in the surrounding area for at least ten (10) years.

H. All individuals installing the fire alarm system must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.

I. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing fire alarm system contractor will be allowed for any portion of the fire alarm system scope of work.

1.6. Acceptable Manufacturer:

A. All fire alarm system devices and equipment shown are manufactured by Notifier to establish product requirements and quality. Acceptable manufacturers are as follows: Notifier, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.

B. All equipment provided shall be available for purchase from at least two authorized distributors within the service area.

1.7. APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

A. National Fire Protection Association (NFPA) - USA:

No. 12	CO2 Extinguishing Systems (low and high)
No. 12B	Halon 1211 Extinguishing Systems
No. 13	Sprinkler Systems
No. 13A	Halon 1301 Extinguishing Systems
No. 15	Water Spray Systems
No. 16	Foam/Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 72	National Fire Alarm Code
No. 101	Life Safety Code

B. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 217	217 Smoke Detectors, Single and Multiple Station
N0. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 60951	Safety of Information Technology Equipment

C. Local and State Building Codes.

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.8. APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL	Underwriters Laboratories Inc
ULC	Underwriters Laboratories Canada

B. The fire alarm control panel shall meet UL Standard 864 Ninth Edition (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).

PART 2.0 PRODUCTS

2.1. EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2. CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760.
4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits, Signaling Line Circuits, and Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.

6. All field wiring shall be electrically supervised for open circuit and ground fault.
7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

C. Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3. MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. Main FACP or network node shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. Operator Control

1. Acknowledge Switch:

   a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:
   Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
3. Alarm Activate (Drill) Switch:
   The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
4. System Reset Switch:
   Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
5. Lamp Test:
   The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid

crystal display and display the panel software revision for service personal

C. System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.
2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
3. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits
4. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
5. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
6. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
7. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.
   The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
8. The FACP or each network node shall provide the following features:

   a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
   b. Detector sensitivity test, meeting requirements of NFPA 72.
   c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
   d. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .02 percent per foot to 2.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
   e. The ability to display or print system reports.
   f. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
   g. PAS presignal, meeting NFPA 72 requirements.
   h. Rapid manual station reporting (under 3 seconds) and shall meet NFPA 72 requirements for activation of notification circuits within 10 seconds of initiating device activation.
   i. Periodic detector test, conducted automatically by the software.
   j. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
   k. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
   l. Walk test, with a check for two detectors set to same address.
   m. Control-by-time for non-fire operations, with holiday schedules.

n. Day/night automatic adjustment of detector sensitivity.
o. Device blink control for sleeping areas.

9. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72), and California Code. Panel notification circuits (NAC 1, 2, 3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."
10. Network Communication

a. The FACP shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

D. Central Microprocessor

1. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

E. System Display

1. The system shall support the following display mode options:

a. 80 character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.

2. The display shall provide all the controls and indicators used by the system operator:

a. The 80-character display shall include the following operator control switches:

ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.

3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
4. The display shall also provide Light-Emitting Diodes.

    a. The 80-character display shall provide 12 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, ALARM SILENCED, Controls Active, Pre-Discharge, Discharge and Abort.

5. The display shall have QWERTY type keypad.

    a. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

6. The system shall support the display of battery charging current and voltage on the 80-character LCD display.

F. System Display

1. The system shall support the following display mode options:

    a. 640-character display option. The design of the CPU shall provide for a configuration with the 640 Character display mounted on the front of the CPU in place of the standard 80-character display.
    b. When configured with a 640-character display option the system shall support distributed digital audio amplifiers on the digital audio loop.

2. The display shall provide all the controls and indicators used by the system operator:

    a. The 640-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.

3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
4. The 640-character display shall provide 11 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY EVENT, SYSTEM TROUBLE, ALARM SILENCED, DISABLED POINTS, OTHER EVENTS, CPU FAILURE and Controls Active.
5. The display shall have QWERTY type keypad.

    a. The 640-character display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility.

F. Signaling Line Circuits (SLC)

1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

G. Serial Interfaces

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.

   b. One EIA-232 interface shall be used to connect an UL-Listed 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.

   c. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

G. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset. The DVC shall support up to 8 channels of voice when configured with Digital Audio Amplifiers and 4 channels of voice when employing the optional analog output card. Each DVC shall support up to 32 digital audio amplifiers.
2. Function: The Voice Command Center equipment shall perform the following functions:
   a. Operate as a supervised multi-channel emergency voice communication system.
   b. Operate as a two-way emergency telephone system control center.
   c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
   d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
   e. Provide all-call Emergency Paging activities through activation of a single control switch.
   f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
   g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
   h. Provide a software utility capable of off-line programming for the VCC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the VCC shall not inhibit the emergency operation of other nodes on the fire alarm network.
   i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SCL controlled switching.

j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

3. The emergency voice alarm communication system shall incorporate a Two-way emergency telephone communication system.
   a. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
   b. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Digital Voice Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
   c. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.

H. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power (@25 Volt RMS or 70 RMS) for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

- Earth Fault on DAP A (Digital Audio Port A)
- Earth Fault on DAP B (Digital Audio Port B)
- Audio Amplifier Failure Detected Trouble
- Active Alarm Bus input
- Audio Detected on Aux Input A
- Audio Detected on Aux Input B
- Audio Detected on Firefighter's Telephone Riser
- Receiving Audio from digital audio riser
- Short circuit on speaker circuit 1
- Short circuit on speaker circuit 2
- Short circuit on speaker circuit 3
- Short circuit on speaker circuit 4
- Data Transmitted on DAP A
- Data Received on DAP A
- Data Transmitted on DAP B
- Data Received on DAP B
- Board failure
- Active fiber optic media connection on port A (fiber optic media applications)
- Active fiber optic media connection on port B (fiber optic media applications)
- Power supply Earth Fault
- Power supply 5V present
- Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble

4. The audio amplifier shall provide the following built-in controls:

- Amplifier Address Selection Switches
- Signal Silence of communication loss annunciation Reset
- Level adjustment for background music

- Enable/Disable for Earth Fault detection on DAP A
- Enable/Disable for Earth Fault detection on DAP A
- Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-tone backup shall be provided by either a plug-in-amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

I. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:

   LED Indicators:
   - Lamp Test
   - Trouble
   - Off-Line Trouble
   - Microphone Trouble
   - Phone Trouble
   - Busy/Wait
   - Page Inhibited
   - Pre/Post Announcement Tone

J. Controls with associated LED Indicators:

1. Speaker Switches/Indicators

   a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
   b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

2. Emergency Two-Way Telephone Control Switches/Indicators

   a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
   b. The telephone circuit control panel shall include switches to manually activate or

deactivate each telephone circuit in the system.

K. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

L. Power Supply:

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

   Ground Fault LED
   AC Power Fail LED
   NAC on LED (4)

5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
7. All circuits shall be power-limited, per UL864 requirements.

M. Auxiliary Field Power Supply - Addressable

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
2. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single

addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.

5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
6. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
9. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
10. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
11. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
12. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
13. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
14. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
15. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
16. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

N. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:

a. Device status
b. Device type
c. Custom device label
d. View analog detector values
e. Device zone assignments
f. All program parameters

5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
6. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
10. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:

    a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
    b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
    c. All devices tested in walk test shall be recorded in the history buffer.

11. Waterflow Operation
    An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
12. Supervisory Operation
    An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
13. Signal Silence Operation

The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.

14. Non-Alarm Input Operation
    Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.
15. Combo Zone
    A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4. SYSTEM COMPONENTS:

A. Speakers:

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.
2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

B. Audible/Visual Combination Devices:

1. Shall meet the applicable requirements of Section A listed above for audibility.
2. Shall meet the requirements of Section B listed above for visibility.

C. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

D. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

E. Conventional Photoelectric Area Smoke Detectors

1. Added note- For all smoke detectors on this project, contractor shall provide notifier self test series detector, #fsp-951-selft in lieu of current smoke detector listed. Any new heat detectors shall also be changed to fsp-951t-selft. Provide all programming and mounting accessories required for

detector install. Contractor shall include all licensing and costs associated with the first year fire alarm inspection as part of their pricing. The first year shall begin upon project substantial completion.

a. Smoke detectors shall be intelligent addressable devices using photoelectric (light scattering) principal to measure smoke density. It shall connect via two wires to the Fire Alarm Control Unit signaling line circuit.

b. The detector shall comply with UL268 7th edition; operating at 24Vdc, nominal.

c. The self-test sensor shall generate a controlled amount of smoke into the chamber which will test the optics in response to a real smoke simulation.

d. The detector shall also measure the dilution of smoke within a set time frame to determine if there is masking that will prevent smoke from entering the chamber.

e. An alarm condition shall be generated upon smoke entering the chamber.

f. A trouble condition shall be generated if the testing chamber reveals it is being blocked.

F. Duct Smoke Detectors

Duct smoke detectors shall be a 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

G. Projected Beam Detectors

1. The projected beam type shall be a 4-wire 24 VDC device.
2. The detector shall be listed to UL 268 and shall consist of a separate transmitter and receiver capable of being powered separately or together.
3. The detector shall operate in either a short range (30' - 100') or long range (100' - 330') mode.
4. The temperature range of the device shall be -22 degrees F to 131 degrees F.
5. The detector shall feature a bank of four alignment LEDs on both the receiver and the transmitter that are used to ensure proper alignment of unit without special tools.
6. Beam detectors shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses.
7. The unit shall be both ceiling and wall mountable.
8. The detector shall have the ability to be tested using calibrated test filters or magnet activated remote test station.

H. Automatic Conventional Heat Detectors

1. Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit (57.2 Celsius) for areas where ambient temperatures do not exceed 100 degrees (37.7 Celsius), and 200 degrees (93.33 Celsius) for areas where the temperature does not exceed 150 degrees (65.5 Celsius).
2. Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.
3. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.

4. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
5. Automatic heat detectors shall have a smooth ceiling rating of 2500 square feet (762 square meters).

I. Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

J. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

    a. This unit shall provide for each zone: alarm indications, using a red alarm and yellow trouble long-life LEDs and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.
    b. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.

K. Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.

6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
7. The system shall allow a minimum of 32 terminal mode LCD annunciators. Up to 10 LCD annunciators shall be capable of the following system functions: Acknowledge, Signal Silence and Reset, which shall be protected from unauthorized use by a key switch or password.
8. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

L. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled as "Emergency Telephone." The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection so that lifting the handset off of the cradle shall send a signal to the fire command center, which shall audibly and visually indicate its on-line (off-hook) condition.
3. On activating the remote phone, the phone earpiece shall sound a telephone ring signal until the master handset is lifted.
4. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

M. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
3. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
4. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
5. Communication shall include vital system status such as:

    - Independent Zone (Alarm, trouble, non-alarm, supervisory)
    - Independent Addressable Device Status
    - AC (Mains) Power Loss
    - Low Battery and Earth Fault
    - System Off Normal
    - 12 and 24 Hour Test Signal
    - Abnormal Test Signal (per UL requirements)
    - EIA-485 Communications Failure
    - Phone Line Failure

6. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This

enables the central station to have exact details concerning the origin of the fire or response emergency.

7. AN IP Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet to a compatible receiver.

N. Field Wiring Terminal Blocks

For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

O. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

N. Voice Evacuation Contol:

1. Provide Notifier DVC-EM connected to main FACP for voice evacuation system. Voice evac will be required throughout the building. Provide ET70-24MCW-FR for wall mounted Speaker Strobe locations and ET90-24MCC-FR for ceiling mounted locations. Provide amplifier quantities as required to achieve proper amplification.

2.1 FIELD DEVICES

A. Photoelectric Smoke Detector (FAPT-751):

1. Notifier Model FAPT-751 Intelligent multi criteria acclimating detector shall be provided where required. The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine it's environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining

the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

B. Intelligent Duct Smoke Detector (FSD 751P):
1. Notifier Model FSD-751P Intelligent duct smoke detectors shall be provided where required. The smoke detector housing shall accommodate an intelligent photoelectric detector, that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to shutdown air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

C. Intelligent Thermal Detectors:
1. Notifier Model FST-751R intelligent thermal detector shall be provided where required. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.
2. Notifier 302 series rate-anticipation thermal detector shall be provided where required . Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) It shall connect via two wires to the fire alarm control panel signaling line circuit.

D. Addressable Manual Stations:
1. Notifier Model NBG-12LX manual stations shall be provided where required. The manual station shall provide address-setting means using rotary decimal switches. No binary coding shall be required.
2. Manual stations shall be designed for semi-flush mounting on standard electrical box. The station shall be constructed of hi-impact red molded Lexan with instructions for station operation in raised white letters. Stations shall be of the dual action type.
3. Install Stopper STI1100 series covers with horns on all manual pull stations.

E. Monitor Module:
1. Notifier Model FMM-101 addressable monitor module or approved equal shall be provided where required. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.

F. Control and Relay Modules
1. Addressable Control Module FCM-1 or approved equal.
   a. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.
   b. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal

operation.

c. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
d. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.
e. Addressable Relay Module FRM-1 or approved equal.
f. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be Form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

G. Remote LCD Alpha-Numeric Annunciators

1. Provide where indicated on the drawings, a Notifier LCD-80TM remote LCD alpha-numeric annunciator or approved equal to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator shall be a backlit eighty-character LCD display and operate via the system RS485 or RS232 serial output terminal from the main FACP. The LCD display shall automatically illuminate upon receipt of an alarm or trouble condition. The illuminary source shall extinguish during normal/standby mode to conserve power. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote LCD annunciator shall include:
   a. Integral time-date clock
   b. Time-date select switch
   c. Time-date/contrast adjust
   d. Display/step switch
   e. System reset
   f. System silence
   g. System acknowledge
   h. Integral trouble buzzer
2. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The unit shall be equipped with an integral lamp test feature. The unit shall be flush mounted where shown.

H. High Intensity Audible Visual Signals:

1. High intensity visual signals shall be installed where required and as may be required by the Americans with Disabilities Act (Public Law 101-336).
2. High intensity visual alarms shall be xenon strobe type producing a minimum of 100 candela on a 24 VDC limited energy supervised circuit. Alarm devices shall be designed to be flush wall mounted. Signals shall operate in unison with audible alarm appliances. High intensity visual signals shall be of solid state low current design and listed to U.L. Standard 464. Alarm devices shall be integral with audible alarm appliances where appropriate.
3. Devices requiring programming onto an SLC circuit shall not be acceptable.
4. Wheelock, Gentex, or approved equal

I. High Intensity Visual Signals:

1. High intensity visual signals shall be installed as may be required by the Americans with Disabilities Act (Public Law 101-336).
2. High intensity visual alarms shall be xenon strobe type producing a minimum of 100 candela on a 24 VDC limited energy supervised circuit. Alarm devices shall be designed to be flush wall mounted. Signals shall operate in unison with audible alarm appliances. High intensity visual signals shall be of solid state low current design and listed to U.L. Standard 464. Alarm devices shall be integral with audible alarm appliances where appropriate.
3. High intensity visual alarms shall be xenon strobe type producing a minimum of 100 candela on a 24 VDC limited energy supervised circuit. Alarm devices shall be designed to be flush wall mounted. Signals shall operate in unison with audible alarm appliances. High intensity visual signals shall be of solid state low current design and listed to U.L. Standard 464. Alarm devices shall be integral with audible alarm appliances where appropriate.
4. Devices requiring programming onto an SLC circuit shall not be acceptable.
5. Wheelock, Gentex, or approved equal

J. Auxiliary AHU Relays:

1. Notifier/Air Products Model MR-101/CR relays or approved equal shall be provided for HVAC and AHU control and interface. Relays shall be heavy duty type and rated up to 10 amps at 24 VDC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with SPDT contacts as well as activated LED indicator. These relays shall be connected hot (fail safe) so that if the cable is broken, disconnected etc., the AHU will automatically shutdown.

G. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

H. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

I. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one

conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.

2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y. For speaker applications the module is rated for 50 watts at 25 or 70.7 Vrms.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.

J. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
2. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

K. Addressable Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.

L. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.6. BATTERIES:

A. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery and charger systems may be used.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying

controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

A. Provide a four hour period of instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel operation and system test procedures. Furnish instruction on peripheral device operation, including what are normal and alarm indications and resetting of each type of device. The Operations and Maintenance Manual shall be complete and on-site at the time of Owner instruction. Demonstrate that when fire alarm sounds, fire alarm system sends signal to mute the buildings' communication system and local sound reinforcement systems in the building.
B. Demonstrate the Fire Drill Pull Station.
C. Demonstrate each local voice evacuation panel.
D. Demonstrate that buildings' communications system properly cuts out upon initiation of fire alarm notification signals. Buildings' communication system shall remain capable of manual override so that staff can deliver emergency voice instructions over the buildings' communications system, even while fire alarm notification signals are still sounding.

3.5 WALK TEST

A. Notify Owner, Architect and Engineer when system is 100 percent operational. Schedule walk-through of the entire facility and verify that each initiating and each indicating device is operating properly.

B. Provide report at conclusion of walk through certifying all fire alarm devices are working.

3.6 ADDITIONAL DEVICES

A. Provide 10% spare devices to be used during the project all remaining devices shall be turned over to the owner at the completion of the project for spare devices.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and **abandoning site utilities in place**.
8. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

2. Section 015639 “Temporary Tree and Plant Protection”

C. Related Requirements:

1. Section 01500 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

2. Section 015639 “Temporary Tree and Plant Protection”

3. Section 024119 “Selective Demo”

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 3 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and **according to requirements in Section 015639 "Temporary Tree and Plant Protection."** Ref. Tree protection plan and sheet for details.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.

D. Utility Locator Service: Notify **utility locator service** for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with surface-tolerant, anticorrosive metal primer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed **or abandoned in place**.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than **two** days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and Dispose of off site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth **6 inches** in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to **96 inches**.
2. Do not stockpile topsoil within protection zones.

3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 STOCKPILING ROCK

A. Remove from **construction area** and stock pile naturally formed rocks that measure more than **2 foot** across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 1 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock **away from edge of excavations** without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to **48 inches.**
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus rock to allow later use by the Owner.

3.8 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 11 00
CLEARING, GRADING, AND EARTHWORK

1. SCOPE:

This section includes the furnishing of all plant, labor, equipment, and materials, and the performance of all operations required to complete the earthwork and grading indicated on the drawings and herein specified, including in general the following: Clearing and grubbing, stripping, excavating, filling, preparation of subgrade, and finished grading of a roadway or drainage ditch in conformity with the line, continuous grade, and typical cross-sections shown on the plans.

2. PROTECTION:

Prior to any earthwork operations, existing utilities, facilities, and/or permanent objects shall be adequately protected. Any cost resulting from damage to the property of the owner due to negligence and/or lack of adequate protection shall be borne by the Contractor.

3. CLEARING AND GRUBBING:

3.1 Minimum Requirements: Clearing and grubbing shall consist of the removal and disposal of trees, stumps, brush, roots, vegetation, logs, rubbish, and other objectionable matter.

3.2 Construction Methods: The entire work area shall be cleared and grubbed of all trees, stumps, brush, logs, and rubbish, except that any curb, sidewalk, storm sewer or appurtenances, or concrete pavement to be constructed under this contract will not be removed. All stumps and roots shall be removed to a depth of two (2) feet below finished subgrade elevation over an area bounded by lines two (2) feet back of curbs. On all other areas, stumps and roots shall be removed to a depth of two (2) feet below the finished surface of the required cross-section.

3.3 Disposal: All cleared and grubbed materials shall become the property of the contractor and shall be removed from the site of the work or disposed of in a satisfactory manner.

4. STRIPPING:

4.1 Minimum Requirements: Stripping consists of the excavations, removal, and satisfactory disposal of all humus, vegetation, or other unsuitable material encountered in all areas which underlie compacted fill or pavement.

4.2 Disposal:

All materials from the stripping operation shall be removed from the site and disposed of by the contractor.

5. EXCAVATION:

After all stripping has been done, excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the drawings. All suitable excavated material shall be transported to and placed in

the fill areas within the limits of the work as specified and as shown on the drawings. Where material encountered within the limits of the work is unsuitable, such materials shall be excavated below the grade shown on the drawings, and then replaced with suitable material. All excavated material which is not required for fill shall be known as "waste" and shall be satisfactorily disposed of by the contractor. All waste shall be disposed of outside the limits of the work. During construction, excavation and filling shall be performed in a manner and sequence that will provide drainage at all times.

6. GRADING:

Grading shall include all necessary scarifying, plowing, moving, and shaping of the earth to afford site drainage and bring the roadbed, slopes, and ditches to the grade line established on the plans and conforming to the typical cross-section shown on the plans.

All undesirable material shall first be removed from within the section to be graded and disposed of as directed by the Engineer.

All materials placed within the limits of the roadbed, under this item, shall be constructed in successive layers, for the full width of the roadbed and in such lengths as are suited to the sprinkling and compaction methods utilized. Prior to compaction, each layer shall not exceed six (6) inches in depth unless otherwise directed by the Engineer, and shall otherwise conform to the requirements of the governing specifications. Around and adjacent to structures, trees, and other obstructions, where it is impractical to do the required work with the equipment specified, such work shall be done by hand labor methods or other approved means.

7. EMBANKMENTS AND FILLS:

7.1 Preparation of Ground Surfaces: All vegetation such as stumps, roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsuitable material within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed, shall be plowed, stepped (benched), or broken up in such manner that the fill material will bond with the existing surface. Prepared surfaces shall be scarified and compacted to 95 percent density at optimum moisture content.

7.2 Formation of Embankments and Fills: Embankments shall be constructed at the locations and to lines and grades indicated on the drawings, within the limits of the work. Embankments shall be formed from earth free from roots or other organic material, trash, frozen material, and rock or stones having a maximum dimension greater than three (3) inches. Embankments shall be constructed in layers and compacted as indicated in the following paragraph or as required in the plans.

8. SUBGRADE PREPARATION:

8.1 General: The subgrade shall be constructed to the lines and grades and typical cross-sections indicated on the drawings and shall allow for the full thickness of the pavement section. In cut areas the subgrade shall be scarified to a depth of seven (7) inches below the surface of the finished subgrade and compacted to 95 percent of maximum density at optimum moisture as determined by AASHO T-99. Material which is not compactable

will be under-cut and replaced with acceptable material excavated within the limits of the project. Material will be deemed not compactable if the required compaction percentage cannot be attained by the use of 25 passes by compaction equipment. The removing and replacing of the unsuitable material will be measured and paid for as "extra excavation". No payment for extra excavation will be made for removing and replacing materials used in the formation of fills or embankments which will not compact to the required density. After compaction, the surface of the subgrade shall not show any deviation in excess of 1/10 foot when tested with a ten (10) foot straightedge applied both parallel to and at right angles to the centerline of the area. The elevation of the finished subgrade shall conform to the elevations shown on the drawings.

8.2 Protection of Subgrade: During construction the subgrade shall be kept shaped and drained. Ditches and drains along the subgrade shall be maintained in such a manner as to drain effectively at all times. When ruts of two (2) inches or more in depth occur in the subgrade, the subgrade shall be brought to grade, reshaped if required, and recompacted prior to placing of paving. The storage or stock-piling of materials on the subgrade will not be permitted. No pavements shall be placed until the subgrade has been properly prepared and in no case shall any pavements be placed in a muddy or soft subgrade.

9. COMPACTION:

9.1 General: Except as otherwise required, all fill shall be placed in uniform layers, dried or moistened as required to obtain approximate optimum moisture content, and rolled where practical to a density of at least 90 percent of maximum dry density at optimum moisture as determined by ASTM D698. Compaction equipment shall be as hereinafter specified. The maximum thickness of uniform layers (loose measurements) shall be as follows:

9.1.1 If the Contractor elects to use the pneumatic roller, the thickness of each uniform layer shall not exceed six (6) inches.

9.1.2 If the Contractor elects to use the tamping rollers, the thickness of each uniform layer shall not exceed six (6) inches.

9.1.3 In locations where it is impractical to use the roller equipment, mechanical hand tampers will be used and the thickness of each layer shall not exceed four (4) inches. The methods used to secure the optimum moisture content will be the Contractor's responsibility. The compacting equipment and the method of compaction shall be such that a uniform density will be obtained over the entire area and depth of material being compacted. All fill material deposited in place by means of scrapers, dump trucks, drag lines, or other similar equipment shall be thoroughly broken up before being spread into the uniform layers. Rolling shall start longitudinally at the low side and proceed toward the high side of sloped areas, by at least one-half (1/2) the width of the roller unit. Alternate trips of the roller shall be slightly different in length.

9.2 Compaction Equipment:

9.2.1 Pneumatic Tire Rollers: The pneumatic tire roller shall have a minimum compression of 325 pounds per inch width of pneumatic tire tread. The

roller shall consist of not less than nine pneumatic tire wheels, running on axles in such a manner that the rear group of tires will not follow in the tracks of the forward group, and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The wheel base of the roller (the distance between the front and rear axles) shall not be less than five feet nor more than ten feet. Rollers shall be maintained in good repair and operating condition.

9.2.2 Sheepsfoot Roller: The sheepsfoot roller or tamping roller shall have a unit weight on the contact feet of not less than 150 pounds per square inch. Tamping rollers shall consist of two metal rollers, drums, or shell of forty (40) inches, minimum diameter each not less than forty-two (42) inches in length and unit-mounted on a rigid frame in such a manner that each roller may oscillate independently of the other, and each roller, drum, or shell shall be surmounted by metal studs with tamping feet projecting not less than seven (7) inches from the surface and spaced not less than six (6) inches nor more than ten (10) inches measured diagonally center to center. The cross-sectional area of each tamping foot, measured perpendicularly to the axis of the stud, shall not be less than five (5) inches nor more than eight (8) square inches. The roller shall be supplemented with cleaning teeth to provide self cleaning.

The roller shall be so designed that by ballast loading, the load on each tamping foot may be varied uniformly from 125 to not less than 175 pounds per square inch of cross-sectional area. The load per tamping foot will be determined by dividing the total weight of the roller by the number of tamping feet in one row parallel to or approximately parallel to the axis of the roller. The compression to be provided at any time shall be directed by the Engineer. The tamping roller shall be drawn by suitable power equipment of adequate tractive effort. Roller shall be maintained in good repair and operating condition and shall be approved by the Engineer.

9.2.3 Mechanical Hand Tampers: Approved mechanical hand tampers shall be used in areas inaccessible to roller equipment. Methods of compaction shall be such that a uniform density is obtained throughout the entire area and depth of each layer.

10. FINISH GRADING:

Uniformly smooth grading of all areas indicated on the drawings to be graded shall be accomplished. The finished surface shall be not more than 0.15 feet above or below the established grade or approved cross-section. All ditches and gutters shall be finished so as to drain readily. Where existing grade is disturbed by the Contractor in areas not marked to be graded, the Contractor will regrade the disturbed area to its original grade at no additional expense to the Owner.

11. TESTS:

In the event the Engineer deems necessary to assure proper compaction of fill or roadway subgrade, the Engineer reserves the right to require Contractor to take cores and have it tested by

an independent qualified testing service. The laboratory will furnish written reports covering results of all tests and inspections made. Reports will be made promptly to the Engineer, Contractor, and Owner.

12. ADDITIONAL CLEARING, GRADING, AND EARTHWORK SPECIFICATIONS

Refer to the Geotechnical Report for more information on earthwork requirements including, but not limited to, site Preparation, grading and drainage of soils, wet weather and soft subgrade conditions, construction observation and testing.

END OF SECTION

SECTION 31 22 15 - FINISH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Machinery restrictions.
2. Excavation, filling and backfilling of on site material.
3. Subgrade preparation and spreading of topsoil.
4. Finished grading.
5. Prevention of excessive weed growth in lawns.
6. Drainage.

B. Related Sections
1. Landscape Rough Grade – Section 31 22 14
2. Lawns and Grasses - Section 32 92 00
3. Planting - Section 32 93 00

1.2 GENERAL PROVISIONS

A. Finished grading shall be defined as placing and grading of additional soil that will be required to bring the grade to the required grades for lawns, shrub and groundcover beds.

B. Additional fill materials shall generally be defined as topsoil as specified herein unless otherwise specified.

C. Where practicable and as directed, the use of heavy machinery shall be kept to a minimum.

D. Refer to Section 32 93 00 for finish grading of shrub and groundcover beds.

1.3 INFORMATIONAL SUBMITTALS

A. Soil analysis of all on site topsoil to be used for finished grading and planting media prior to stock piling. Soil tests/analysis to be submitted to Landscape Architect along with any planned amendments to meet requirements.

PART 2 - PRODUCTS

2.1 FILL

A. General Qualifications: Fill shall be a clean, dry soil of a loamy character, well drained and well graded with a plasticity index not to exceed 20 or fall below 8. Fill material shall contain no oils, alkalies, acids, rubbish or other deleterious materials. The pH shall be similar to the approved topsoil.

2.2 TOPSOIL

A. Topsoil material that will be required for finish grading operations shall conform to the requirements included within this Section and shall come from on site stockpiles.

B. General Qualifications for Topsoil:
"On-Site" Topsoil shall be considered as material conforming to the following minimum criteria:
1. Natural, friable, loamy soil, typical of local topsoil which produces heavy vegetative growth, free from subsoil, weeds, sods, stiff clay, stones larger than 1", toxic substances, debris, or other substances which may be harmful to plant growth. Do not deliver in muddy condition.
2. Acidity/Alkalinity: pH 6.0 to pH 7.5.

C. Grading Analysis: 2" sieve, 100% minimum passing. Number 4 sieve, 90% minimum passing. Number 10 sieve, 80%minimum passing.
1. Sand, Silt, and Clay Content (from ASSHTO M146):
   a. Sand 20 - 45%
   b. Silt 20 - 40%
   c. Clay 10 -15%
2. All topsoil shall be free from all herbicides and insecticides which might adversely affect subsequent growth of turf or plantings or which might otherwise contain materials toxic to humans and pets.

D. Non-Conforming Material: The Contractor shall not be permitted to use on-site material which does not conform to the above minimum criteria for fine grade operations. At the discretion of the Owner's representative, such material can either be amended to meet the minimum requirements or shall be removed from the site and replaced with suitable material as specified herein.

E. It shall be the Contractor's responsibility to verify that the existing topsoil conforms to these specifications. Topsoil determined to be non-conforming subsequent to the award of a contract shall not be means for extra compensation unless otherwise provided for herein.

F. Soil Analysis: The Contractor shall obtain an agricultural soil analysis of topsoil taken from four areas of the site. These samples shall be submitted to an accredited and approved soils laboratory at Contractor's cost. Submit results of soil analysis to the Owner for review. The soil analysis shall include recommendations for amendments to the soil to produce optimum plant growth from the variety of plants and grasses proposed. These amendments shall be made at the Contractor's expense and shall be included in the bid.

2.3 SAND

A. Shall be Bank Sand. Sample shall be submitted for approval. Sand shall be used for minor finish grade corrections and shall not be permitted for grading purposes if the depth exceeds 1/2" to achieve the finished grade.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. Work shall be performed by personnel trained and experienced in this work and shall be done under the direction of a superintendent on Contractor's staff.

3.2 PREPARATION OF SUBGRADE AND SPREADING OF TOPSOIL

A. The subgrade soil when at optimum soil moisture shall be loosened to a depth of 4" by disking or tilling and then graded to remove all ridges and depressions so that it will be everywhere parallel to the proposed finished grade. All stones over 1 1/2" in any dimensions, sticks, rubbish and other extraneous matter shall be removed during this operation. If soil clumps over 2” in diameter remain, then make additional passes with a harrow or other approved equipment to reduce below the 2” size. No heavy objects except rollers shall be moved over lawn areas after the subgrade soil has been prepared before topsoil is spread.

B. After the subgrade soil has been prepared, topsoil from the stockpile areas and imported topsoil shall be spread evenly therein to depth of 4" by an approved method. No topsoil shall be spread in a frozen or muddy condition. Areas to receive topsoil are defined as follows:
   1. “On-Site Topsoil” – Areas to receive grass (sod, hydroseed, native seeding).

C. On all grass areas, the finished surface of the topsoil shall conform to the finished grade and shall be free from hollows or other inequalities, stones, sticks and other extraneous matter.

D. Existing “Topsoil” will not be used for groundcover, perennial, or shrub areas to meet final grade. Imported planting soil shall be used to “cap” the repurposed topsoil and eliminate the germination of any dormant seed.

3.3 FINISH GRADING

A. In areas to receive lawns, this Contractor shall till, disc, or otherwise scarify the soil to a depth of 4” removing all clods, stones, and related material 1" or larger.

B. This Contractor shall be responsible for minor adjustments to the finished subgrade if such treatment is required in the opinion of the Owner’s representative.

C. The Contractor may use machinery acceptable to the Owner’s representative to complete most of the work to re-establishing finished grade.

D. Hand-rake the surface, removing all clods and undesirable material greater than 1/2" from ground surface. Fill all low spots and cut irregularities to the acceptance of the Owner’s representative. Roll the entire surface evenly with a 200 pound water ballast roller or other means acceptable.

E. During the finished grading operations, all swales and additional swales that may be required to drain areas where there are existing plant materials, shall be finished. In general, all grade adjustments shall be made so there are no areas that will have standing water.

F. To prevent excessive weed growth in the lawn areas, the Contractor should be prepared to immediately install the sod or seeding upon the completed and acceptable finished grade.

G. Prior to installation of grass or groundcovers, contact Landscape Architect to inspect and approve finish grade.

END OF SECTION 31 22 15

SECTION 31 23 00
EXCAVATION, TRENCHING, & BACKFILLING REQUIREMENTS

1. SCOPE:

This section covers excavation and trenching work and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of sub-grades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; and other appurtenant work.

2. GENERAL:

2.1 Rights-of-Way: The necessary rights-of-way for the work will be provided by the Owner. The Contractor shall confine his construction operations to the immediate vicinity of the location shown on the drawings and shall use due care in placing construction tools, equipment, excavated materials, and pipe line materials and supplies so as to cause the least possible damage to property and interference with traffic.

2.2 If it is necessary or desirable that the Contractor use or occupy land outside of the Owner's right-of-way, the Contractor shall obtain consent from and shall execute a written agreement with, the Owner and tenant of the land. The Contractor shall not enter for pipe delivery or occupy for any other purposes with men, tools, equipment, construction materials, or with materials excavated from the pipe trench, any private property outside the right-of-way without written permission from the Owner and tenant of the entered or occupied property.

2.3 Damage to Existing Property: The Contractor will be held responsible for any damage to existing structures, work, materials, or equipment because of his operations and shall repair or replace any damaged structures, work, materials, or equipment to the satisfaction of, and at no additional cost to, the Owner.

2.4 The Contractor shall protect all existing structures and all other existing property from damage and shall provide all bracing, shoring, or other work necessary for such protection.

2.5 Land for Construction Purposes: The Contractor will be permitted to use available space belonging to the Owner for construction purposes and for the storage of materials and equipment. The location and extent of the areas so used shall be as designated and approved by the Owner.

2.6 It shall be clearly understood that the responsibility for the protection and safekeeping of equipment and materials on or near the site will be wholly and entirely that of the Contractor and that no claim whatsoever shall be made against the Owner by reason of acts occurring upon said substances by employees or trespassers. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials and equipment, the Contractor owning or responsible for the stored materials or equipment shall immediately move same. No materials or equipment may be placed upon the property of the Owner until the Owner has approved the proposed location contemplated by the Contractor to be used for storage.

2.7 Final Cleanup: Upon completion of the work and before acceptance and final payment, the Contractor shall remove rubbish, unused materials, and temporary structures from the limits of the project and restore all property both public and private that has been damaged during the prosecution of the work, and shall level and grade all portions of the work where the surface of the natural ground has been disturbed during construction and shall leave the site of the work in a neat and presentable condition, free from ruts or holes.

3. STRIPPING:

3.1 Minimum Requirements: Stripping shall consist of the excavation, removal, and satisfactory disposal of all humus, vegetation, or other unsuitable materials encountered with the top four (4) inches of soil in all areas which underlie foundations or slabs.

3.2 Disposal: Materials from the stripping operations shall be removed from the site or disposed of by the Contractor in a satisfactory manner.

4. CLASSIFICATION OF EXCAVATED MATERIALS:

No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

5. BLASTING:

No blasting or other use of explosive for excavation will be permitted on the site of the work.

6. UNAUTHORIZED EXCAVATION:

Except where otherwise authorized, shown, or specified, all material excavated below the bottom of concrete footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor with concrete placed at the same time and monolithic with the concrete above.

7. REMOVAL OF WATER:

The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other causes will result.

7.1 All excavations for concrete structures or trenches which extend down to or below the static ground water elevations shall be dewatered by lowering and maintaining the ground water surface beneath such excavation to a distance of not less than twelve inches below the bottom of the excavation.

7.2 Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches, to the greatest extent practicable without causing damage to adjacent property.

7.3 The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free from sediment.

8. SHEETING AND SHORING:

Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, and shored as necessary to prevent caving or sliding, to provide protection for the workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure, and shall be rigid, maintaining shape and position under all circumstances.

9. STABILIZATION:

Trench bottoms and subgrades for concrete structures shall be firm, dense, and thoroughly compacted and consolidated and shall be free from mud and muck and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

10. TRENCH EXCAVATIONS:

10.1 Mechanical Excavation: Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical side walls are obtained at least from an elevation six (6) inches above the top of the installed pipe to the bottom of the trench, and that the trench alignment is such that the pipe, when accurately laid to specified alignment clearance between the pipe and side walls of the trench. Undercutting of the trench side wall to obtain clearance will not be permitted.

10.2 Maintain all mechanical trenching equipment in good operating condition. Maintain and comply with safe operating procedures.

10.3 Artificial Foundations in Trenches: Whenever unstable material is encountered below subgrade, remove unstable material to a depth two feet below subgrade and replace with suitable material or install properly designed timber or concrete foundations, pipes, posts, or stringers as necessary to provide appropriate subgrade.

10.4 Bell Holes: Bell holes shall provide adequate clearance for the tools and methods used in installing the pipe. No part of any bell or coupling shall be in contact with the trench bottom or trench walls when the pipe is jointed.

11. PIPE EMBEDMENT:

The trench bottom shall be shaped to give uniform and continuous support to the bottom quadrant of the pipe between joints. Selected trench excavated materials shall be used for pipe embedment in accordance with detail on plans.

11.1 After each pipe has been graded, aligned, and placed in final position, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to firmly hold and maintain the pipe in proper position and alignment during subsequent pipe jointing, embedment, and backfilling operations as indicated in detail shown on plans.

11.2 Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement of the pipe.

11.3 Tamped backfill materials shall be placed in uniform layers and shall have a moisture content which will ensure that the maximum density will be obtained with the compaction method used.

12. TRENCH BACKFILL:

Bank sand shall be placed and tamped in six inch layers until backfill is twelve inches above top of pipe, then the balance of the backfill consisting of native soil may be placed with one of the following methods:

12.1 Placement and Tamping in 12 Inch Layers: Compaction shall be approximately equal to that of adjacent undisturbed material.

12.2 Water Settled Earth Backfill: Where water settlement of earth backfill is permitted, water shall be applied in a manner which will provide effective settlement of the backfill with a minimum amount of water; in no case shall the trenches be permitted to overflow or water to be otherwise wasted. Settlement by water puddling shall not be done until after the trench has been backfilled to or above the ground surface.

Water shall be introduced into the bottom of the trench through a long pipe nozzle so the disturbance of any tamped material below will be held to an absolute minimum. Backfill material to compensate for settlement below surface grade shall be added as necessary and settled during puddling operations.

13. STRUCTURE BACKFILL:

Cement stabilized sand backfill shall be compacted in six inch layers to a density equal to at least 95 percent of maximum density as determined in accordance with ASTM D698 (Standard Proctor Density). All other backfill around structures shall be compacted in 12 inch layers to a density approximately equal to the adjacent undisturbed earth.

14. LINES, LEVELS, AND CLEARANCES:

Excavate to the lines and limits required for the installation of all work. In addition, provide sufficient clearance for proper execution of work such as forming, draining, and removing unsuitable material.

15. EXISTING UNDERGROUND CONDUIT AND PIPING:

When underground utility lines are encountered, immediately notify the Engineer and the proper authorities. Cooperate with the authorities to facilitate permanent protection, re-routing, and removal of such lines. If so directed, remove and cap or plug any such lines found to be abandoned or inactive.

16. SPECIAL REQUIREMENTS:

Fill all holes and depressions left by removal of trees, shrubs, improvements, etc. with approved fill and compact to 95% density.

17. PROTECTION:

Adequately protect newly graded areas to prevent washing.

18. BACKFILL MATERIALS:

Material for backfill other than cement stabilized sand backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically compacted backfill shall be deposited or compacted in water. Cement stabilized sand backfill shall consist of clean, hard, durable, uncoated, grains of washed sand, free from all objectionable materials such as clay or organic matter.

19. DRAINAGE MAINTENANCE:

Trenches across roadways, driveways, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to the completion of backfilling of the trench on the upstream side of the trafficway, to prevent the impounding of water after the pipe has been laid. Backfilling shall be done so that the water will not accumulate in unfilled or partially filled trenches.

All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the section, grade, and contours of ditches or water courses shall be restored to their original condition. Surface drainage shall not be obstructed longer than necessary.

20. DISPOSAL OF EXCESS EXCAVATED MATERIALS:

Except as otherwise permitted, all excess excavated materials shall be disposed on the site of the work.

Broken concrete and other debris encountered in the excavation work, and other similar waste materials shall be disposed of away from the site of the work.

The disposal of waste and excess excavated materials, including hauling, handling, leveling, and surfacing shall be a subsidiary obligation of the Contractor and no separate payment will be made therefor.

21. BACKFILL SETTLEMENT:

The Contractor shall be responsible for all settlement of backfill which may occur within a period of one year after the date of final completion of the contract under which the backfilling work was performed. The Contractor shall make, or cause to be made, all necessary backfill replacements, and repairs or replacement appurtenant thereto, within 30 days after notice by the Engineer or Owner.

END OF SECTION

SECTION 31 23 19
DEWATERING AND DRAINAGE OF EXCAVATION

1. GENERAL:

1.1 Scope:

This section provides for furnishing all labor, materials, equipment, power, and incidentals, and for performing all operations necessary to dewater, drain, and maintain excavations and foundation beds as described herein and as necessary for construction of structures and appurtenances. Included are construction, maintenance, and removal of cofferdams; installing, maintaining, operating, and removing well point systems and other approved devices for lowering water table within an excavation; removal of standing water, surface drainage and seepage from excavation or other work, and protecting work against rising waters and floods, and repair of any resulting damage.

1.2 Contractor's Responsibility:

Contractor shall assume sole responsibility for dewatering systems and for all loss or damage resulting from partial or complete failure of protective measures, except as otherwise provided in the General and Special Conditions.

1.3 Plans and Other Data to be Submitted:

Submit plans for review by the Engineer of proposed methods of dewatering, foundation drainage and diversion, in accordance with sound engineering practice.

1.3.1 Well Point System:

Show the well point system in clear detail, including the pump capacity, or other proposed method for lowering the water table within the areas where sewer pipe, concrete structures, compacted fill and backfill are to be constructed.

1.3.2 Equipment Supplier:

Name the supplier of well point or other foundation drainage equipment.

1.3.3 Review:

Do not start dewatering or other foundation drainage until construction plans and other data required in this paragraph are reviewed.

1.4 Related Work:

Excavation, trenching, and backfilling for utilities.
Structural excavation and backfill.

1.5 Measurement and Payment:

Measurement and payment will be by the linear foot of well point system, if used, parallel to the trench regardless of whether one or more "systems" are used. No separate

payment will be made for dewatering of trench or excavations due to rainfall.

2. PRODUCTS:

Select equipment and material desired.

3. EXECUTION:

3.1 Dewatering Excavations:

3.1.1 Installation and Maintenance:

Furnish, install, operate, and maintain all necessary pumping for dewatering and the various parts of the work and for maintaining free of water the foundations, trenches, and such other parts of the work as required for construction operations. Also, as required for inspections and safety, or for any reason determined by the Engineer to be desirable.

3.1.2 Procedure:

Continue dewatering in all required areas, until the concrete structure, the trench, or other structure, has been completed to the top of the slopes of the excavation, or to another designated level.

3.1.3 Drain Pipe:

Provide a uniform diameter for each pipe drain run constructed for dewatering. Remove the drain pipe when it has served its purpose. If removal of the pipe is impractical, provide grout connections at 50 foot intervals, and fill the pipe with clay grout or cement and sand grout when the pipe has served its purpose.

3.1.4 Removal of Cofferdam:

After completion of construction at the site, remove the cofferdams and dispose of the material.

3.1.5 Replacement of Disturbed Material:

Replace any excavation performed for convenience in the foundation beds with materials as impermeable as the original foundation material, and compacted to not less than 95% maximum density.

3.2 Drainage of Foundation Beds:

3.2.1 Procedure:

Dewater foundation beds for concrete structures by using well points or another approved method. Maintain the saturation line at least 2 feet below the lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep foundation beds free from water for three (3) days after concrete is placed.

3.2.2 Alternatives:

Produce a downward seepage of water through the sandy materials in the foundation beds, promoting their compaction as the water table drops. Be prepared to demonstrate that the method proposed will produce the desired results. Be prepared to adopt other means of obtaining these effects if the proposed method fails.

3.3 Requirements for Well Points:

3.3.1 Installation and Acceptance:

Well points, where used, must be furnished, installed, and operated by a reputable contractor regularly engaged in this business, and approved. Submit the design of the well point system for review by the Engineer. Predrain by well point vacuum method.

3.3.2 Alternatives:

Well points may be omitted for portions of underdrains or other trenches only where auger borings and piezometers show that the soil is predrained by an exterior system.

3.4 Duration of Drainage:

3.4.1 Procedure:

In areas where concrete is to be placed, carry out the foundation drainage so that the required lowering of the water table will be affected prior to placing reinforcing steel. Keep foundation beds free from water to the same levels for three days after pouring concrete.

3.4.2 Operation:

Operate pumps to keep each underdrain system drained to the approximate level of the top of the lowest pipe of the system until the removal or flooding of cofferdams. Pipe manholes are provided for this purpose adjacent to the structures.

3.5 Cofferdam Requirements:

3.5.1 Procedure:

Provide a suitable cofferdam for each excavation where necessary to control water, so the foundation can be placed dry. Also provide a suitable cofferdam to prevent sliding and caving of walls of the excavation.

a. Where no ground or surface water is encountered, the cofferdam only need be sufficient to protect workmen and to avoid having cave-ins or slides extend beyond the limits of the excavation, as drawn.

b. Provide cofferdams with enough clearance for the construction and

removal of any required forms, for the inspection of their exteriors, and to permit pumping outside the forms.

3.5.2 Requirements:

Extend sheet piling cofferdams well below the bottom of footings. Brace the piling well and make as watertight as possible.

3.6 Flooding and Removal of Cofferdams:

3.6.1 Procedure:

Provide for admitting water gradually behind the cofferdam to equalize the water level on the two sides of the cofferdam before it is flooded or breached. Use this feature before the cofferdam is removed, and in the event of a flood that could overtop the cofferdam.

3.6.2 Requirements:

Do not breach cofferdams where the water level differential is more than 2 feet between the two sides of the cofferdam, unless the water depth on the high side is no more than 3 feet at the point of breaching.

3.7 Protection of Structures

3.7.1 Requirements:

Operate construction equipment over completed slabs or structures only with approval. Rubber tire equipment heavier than five (5) tons and crawlers heavier than seven (7) tons will require adequate load spreading by sand fill or other means.

3.8 Repair or Damage:

Assume full responsibility for all loss and damage due to flood, rising water, or seepage in any part of the work. Repair any damage to partially completed work from these or other causes, including the removal of slides, repair of foundation beds, and performance of any other work necessitated by failure or slippage of cofferdams or lack of adequate dewatering or drainage facilities.

END OF SECTION

SECTION 31 23 23.16
CEMENT STABILIZED SAND BACKFILL

1. GENERAL:

1.1. Scope: This section provides for the use of cement-stabilized sand as bedding material under sewer pipes, as backfill material around sewer pipes, manholes, inlets, and drainage structures, as required, and for backfill under pavement sections.

1.2. Related Work:

a. Storm Sewers
b. Sanitary Sewers
c. Excavation, Trenching, and Backfilling Requirements

1.3. Measurement and Payment: No separate payment for work performed under this item for bedding around pipe. Include cost of same in contract prices bid for which this work is a component. For special cement stabilized sand backfill under pavement sections, a separate bid item is provided in the bid proposal paid for by the linear foot of pipe.

2. PRODUCTS:

2.1. Materials:

2.1.1. Aggregate: Use washed sand from an approved source having a Plasticity Index of four (4) or less, and containing deleterious materials not exceeding the following requirements, by weight:

Material Removed by Decantation -	5.0%
Clay Lumps -	0.5%
Other deleterious substances such as coal, shale, coated grains of soft flaky particles -	2.0%

Graduation Requirements:

Retained on 3/8-inch screen -	0%
Retained on 1/4-inch screen -	0% - 5%
Retained on 20 mesh screen -	15% - 50%
Retained on 100 mesh screen -	80% - 100%

Color Test ASTM C-40 color not darker than standard color.

2.1.2. Portland Cement: Furnish Portland Cement to conform with ASTM C-150 Type I.

2.1.3. Water: Water shall be reasonably clean and free from injurious amounts of oil, acid, salt, organic matter, or other deleterious material.

2.2. Proportioning and Mixing: Use not less than one and one-half (1-1/2) sacks of cement per cubic yard of mixture. Use amount of water required to prove mix suitable for mechanical hand tamping and mix in mixer approved by the Engineer. Stamp batch tickets at plant with time of loading. Material not in place within one and one-half hour

after loading or has obtained an initial set will be rejected and removed from the site.

3. EXECUTION:

3.1.

a. Place cement-stabilized sand in a trench or excavation prepared for sewer pipe to the depth shown on the drawings.

b. After bedding material is in place, set pipes in position to grade.

c. Add additional cement-stabilized sand material around pipe, filling to at least the spring line of the pipe. Place cement-stabilized sand at optimum moisture content, and in layers not to exceed six inches (6"), measured loose.

d. Compact with mechanical hand tamps to at least 95% of AASHTO density, Test Method T-99.

3.2. Backfill Procedures:

a. Place cement-stabilized sand up to the top twelve inches (12") of sewer trenches under existing or future pavement. Use cement-stabilized sand as backfill material around manholes or sewer trenches that are within one foot (1') of pavement.

b. Place cement-stabilized sand at optimum moisture content in layers not to exceed twelve inches (12"), measured loose.

c. Compact with mechanical hand tamps to at least 95% of prescribed AASHTO Density, Test Method T-99.

d. Place cement-stabilized sand continuously a minimum of twelve inches (12") under and around all inlets and all structures as shown.

END OF SECTION

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Furnishing and applying both pre-construction and post-construction subterranean termite control treatment as described herein on the Project.

1.3 COORDINATION

A. Each offeror shall be responsible for determining during the proposal period the extent that any addenda issued during the proposal period may affect this Section of the Specifications.

B. Reference instructions to offerors for requirements regarding substitutions of materials and products.

C. Where conflicts occur between the Drawings and Specifications, between different drawings, between portions of this Section of the Specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

D. Contractor shall notify Structural Pest Control Board (SPCB) prior to application of termite treatment at the site as required by law.

E. Comply with all federal, state and local requirements and authorities having jurisdiction.
   1. QUALITY ASSURANCE

F. Applicator shall be bonded and licensed with all applicable authorities.

G. Products and application techniques shall meet all requirements of federal, state and local regulations regardless of products and techniques specified herein.
   1. SUBMITTALS

H. Product Data:
   1. Manufacturer’s printed literature describing products and detailed application requirements.
      a. Document that product is currently allowed by the Environmental Protection Agency (EPA), the State of Texas, and all applicable county and local authorities for use under building slabs.
   2. Material Safety Data Sheet (MSDS).

I. Samples:
      a. Of proposed written warranty.

J. Certification:
      a. After completion of Work under this Section, submit manufacturer’s signed affidavit, verifying specification compliance of the chemicals, their proportions, and application.
      b. Contractor shall certify that pesticide used on project does not contain the chemical or have any ingredient known as “Dursban”.
   2. WARRANTY

K. Provide written warranty against defects in materials and application for a period of five (5) years after application.

L. Defects shall include, but not be limited to the following:
   1. Evidence of activity by subterranean type termites.
   2. Damage of building materials due to subterranean termites.

M. During the warranty period the applicator shall, at his own expense provide additional termite treatment as required to prevent termite activity. Repair or replace building materials damaged by subterranean termite activity during the warranty period at no expense to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Termidor 80 WG Termitcide/Insecticide (EPA Reg. No. 7969-209) as manufactured by BASF Corporation, Florham Park, NJ; (973) 245-6000 or comparable product approved by Architect with minimum five (5) years of experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions in order to be considered.

1. MATERIALS
    a. Dry powder containing 80% active ingredient and is conveniently package in water-soluble packages (paks).
    b. Finished dilution: 0.125%.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspect building earth fill and foundation excavation for readiness and to ensure that soils are not too wet for proper application of treatment.

B. Post conspicuous warning signs indicating date(s) and time(s) of application and notify contractors working in area of such date(s) and time(s).

3.2 MIXING

A. Mixing shall be in accordance with manufacturer’s printed instructions.

3.3 APPLICATION

A. Do not apply while school is in session.

B. Apply to ensure a continuous chemical barrier.

C. Pre-Construction Treatment:
    a. Apply an overall treatment to the entire surface of soil or other substrate to be covered by the slab, including areas to be under carports, porches, basement floor, and entrance platforms in accordance with manufacturer’s printed instructions and recommended application rates.
    b. Apply along inside of foundation walls, and around plumbing, bath traps, utility services, and other features that penetrate the slab in accordance with manufacturer’s printed instructions and recommended application rates.
    c. Apply at crawl spaces, at hollow block foundations or voids in masonry resting on the footing, and at plenums in accordance with manufacturer’s printed instructions and recommended application rates.

D. Post-Construction Treatment:
    a. Apply a treatment under the slab, including attached porches, carports, entrance platforms, garages and similar slab structures in accordance with manufacturer’s printed instructions and recommended application rates. Drill all holes spaced in a manner to allow for application of a continuous chemical barrier. Plug and fill all drill holes in occupied areas or where visually exposed with a suitable sealant recommended by manufacturer.
    b. Apply at existing cracks and cold, construction and expansion joints and around bath traps, plumbing and utility services which penetrate the slab in accordance with manufacturer’s printed instructions and recommended application rates.
    c. Apply at crawl spaces in accordance with manufacturer’s printed instructions and recommended application rates.

E. At perimeter grade beams, trench along beams or use rodding as recommended by the manufacturer. The final treatment of the exterior beam will be performed within 30 days of notification of completion of landscaping or one (1) year from the date of completion of construction.

F. Allow for drying after application, in accordance with manufacturer's instructions, before placing vapor barrier and beginning concrete placement or other construction activities.

G. All treatment applications must be in compliance with all federal, state, and local laws and regulations with regard to mixing, applying, and disposing of debris and waste.

END OF SECTION 31 31 16

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SECTION 313213.19
LIME STABILIZATION

1. GENERAL:

This item shall consist of treating the subgrade, existing sub-base or existing base by the pulverizing, addition of lime, mixing and compacting the mixed material to the required density. This item applies to natural ground, embankment, or existing pavement structure and shall be constructed as specified herein and in conformity with the typical sections, lines, and grades as shown on the plans or as established by the Engineer.

2. MATERIALS:

Hydrated lime or lime slurry.

2.1. Type A, Hydrated Lime: Shall consist of a dry powder obtained by treating quicklime with enough water to satisfy its chemical affinity for water under the conditions of its hydration. This material is to consist essentially of calcium hydroxide or a mixture of calcium hydroxide and a small allowable percentage of calcium oxide, magnesium oxide and magnesium hydroxide.

When sampled and tested according to prescribed Texas Highway Department procedure, hydrated lime shall conform to the following requirements as to chemical composition:

Hydrate Alkalinity, Percent By Weight Ca (CH) --	Min.	90.0%
Unhydrated Lime Content, Percent By Weight CaC --	Min.	5.0%
"Free Water" Content, Percent by Weight H_2O --	Min.	4.0%

The percent by weight of residue retained shall conform to the following requirements:

Residue Retained on a No. 6 (3360-Micron) Sieve --		0.0%
Residue Retained on a No. 10 (2000-Micron) Sieve --	Max.	1.0%
Residue Retained on a No. 30 (590-Micron) Sieve --	Max.	2.5%

Specifications for Type A applies specifically to the normal hydrate of lime made from "high calcium" type limestone. Hydrated lime for stabilization purposes shall be applied, as provided in the governing specifications, as a dry powder.

2.2. Type B, Commercial Lime Slurry: Pumpable suspension of solids in water. Water or liquid portion of slurry shall not contain dissolved material in sufficient quantity and/or nature injurious or objectionable for purpose intended. Solids portion of mixture when considered on basis of "solids content" shall consist principally of hydrated lime or quality and fineness sufficient to meet the following requirements as to chemical composition and residue.

2.2.1. Chemical Composition: The "solids content" of lime slurry shall have hydrate alkalinity $Ca(OH)_2$ of not less than 90 percent by weight.

2.2.2. Residue: Percent by weight or residue retained in "solids content" of lime slurry shall conform to the following requirements:

Residue Retained on a #6 (3360-Micron) Sieve --	Max.	0.0%
Residue Retained on a #10 (2000 Micron) Sieve --	Max.	1.0%
Residue Retained on a #30 (590 Micron) Sieve --	Max.	2.5%

2.2.3. Type B, Commercial Lime Slurry, shall conform to one of the following 2 grades:

a. Grade 1. "Dry Solids Contents" at least 31 percent by weight of slurry.

b. Grade 2. "Dry Solids Contents" at least 35 percent by weight of slurry.

3. EQUIPMENT:

3.1. Hydrated lime shall be stored in weatherproof (protected from dampness) containers, bins, and buildings until immediately before distribution.

3.2. Hydrated lime shall be weighed in:

a. Truck with approved scale.

b. Bags which are routinely checked for accuracy.

3.3. Applicate truck shall have approved agitator.

4. CONSTRUCTION METHODS:

4.1. Preparation: The roadbed shall be constructed and shaped to conform to the typical sections, lines, and grades as shown on the plans or as established by the Engineer. The material, either before or after lime is added, shall be excavated to the secondary grade (proposed bottom of lime treatment) and removed or windrowed to expose the secondary grade. Any wet or unstable materials below the secondary grade shall be corrected, as directed by the Engineer, by scarifying, adding lime, and compacting until it is of uniform stability.

If the Contractor elects to use a cutting and pulverizing machine that will remove the subgrade material accurately to the secondary grade and pulverize the material at the same time, he will not be required to expose the secondary grade nor windrow the material. However, the Contractor shall be required to roll the subgrade, as directed by the Engineer, before using the pulverizing machine and correct any soft areas that this rolling may reveal.

This method will be permitted only where a machine is provided which will insure that the material is cut uniformly to the proper depth and which has cutters that will plane the secondary grade to a smooth surface over the entire width of the cut. The machine shall be of such design that a visible indication is given at all times that the machine is cutting to the proper depth.

4.2. Application: Lime shall be spread only on that area where the first mixing operations can be completed during the same working day.

4.2.1. The lime shall be spread by an approved screw type spreader box or by bag distribution at the rates shown on the plans or as directed by the Engineer.

The lime shall be distributed at a uniform rate and in such manner as to reduce the scattering of lime by wind to a minimum. Lime shall not be applied when

wind conditions, in the opinion of the Engineer, are such that blowing lime becomes objectionable to traffic and adjacent property owners. A motor grader shall not be used to spread the lime.

The material shall be sprinkled as directed by the Engineer until the proper moisture content has been secured.

4.2.2. Slurry Placement: The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry. Type B, Commercial Lime Slurry, shall be applied with a lime percentage not less than that applicable for the grade used. The distribution of lime at the rates shown on the plans or as directed by the Engineer shall be attained by successive passes over a measured section of roadway until the proper moisture and lime content has been secured. The distributor truck shall be equipped with an agitator which will keep the lime and water in a uniform mixture.

4.3. Mixing:

4.3.1. First - The lime and soil shall be thoroughly blended to required depth by pulverizer-type road mixer. After adding moisture, mixture shall be cured 1 to 3 days.

4.3.2. Final - The cured mixture shall again be pulverized. Clods or lumps shall be broken and firm particles returned by No. 4 sieve shall be removed. The remainder shall meet the following requirements:

Min. Passing 1-3/4" Sieve -	100%
Min. Passing No. 4 Sieve -	60%

4.4. Compaction:

4.4.1. Performed immediately after final mixing.

4.4.2. Optimum moisture content to be provided.

4.4.3. Beginning at bottom, compaction entire depth with tamping rollers.

4.4.4. Underlying subgrade material shall not be disturbed.

4.4.5. Weak spots shall be reworked.

4.4.6. Surface shall be smoothed.

5. FINISHING, CURING, AND PREPARATION FOR SURFACING:

After the final layer or course of the lime treated subgrade, sub-base, or base has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling as directed with a pneumatic or other suitable roller sufficiently light to prevent hair cracking. The completed section shall be moist-cured for a minimum of four (4) days before further courses are added or any traffic is permitted, unless otherwise directed by the Engineer. In cases where subgrade treatment or sub-base sets up sufficiently to prevent objectionable damage from traffic, such layers may be opened to traffic

two (2) days after compaction. If the plans provide for the treated material to be sealed or covered by other courses of material, such seal or course shall be applied within fourteen (14) days unless otherwise directed by the Engineer.

6. TESTS:

The Contractor will be required to have a "Standard Density Test" ASTM D-698-58T, test until 95% of maximum dry density at optimum moisture content is achieved by pneumatic-type rollers. The Contractor will be required to take core and have it tested by an independent qualified testing service every 500 square yards on the subgrade. The laboratory will furnish written reports covering results of all tests and inspections made. Reports will be made promptly to the Engineer, Contractor, and Owner.

7. MEASUREMENT:

Lime treatment of the subgrade, existing sub-base, and existing base shall be measured by the square yard to neat lines as shown on the typical sections.

END OF SECTION

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Sections:
1. Section 013200 "Construction Progress Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Section 015000 "Temporary Facilities and Controls" for temporary utilities and support facilities.
3. Section 312000 "Earth Moving"
4. Section 312319 "Dewatering" for dewatering system for excavations.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Monitor vibrations, settlements, and movements.

1.4 SUBMITTALS

A. Shop Drawings: For excavation support and protection system.

B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Other Informational Submittals:
1. Photographs or Videotape: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.
    a. Note locations and capping depth of wells and well points.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
   1. Notify all impacted parties including Owner no fewer than five (5) days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
   1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
   2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Identify benchmarks and record existing elevations.
   1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Delete this article if Contractor selects temporary excavation support and protection. Revise materials if prescribing excavation support and protection system requirements.

B. General: Provide materials that are either new or in serviceable condition.

C. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

D. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
   1. Corners: Site-fabricated mechanical interlock or roll-formed corner shape with continuous interlock.

E. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

F. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

G. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

H. Tiebacks: Steel bars, ASTM A 722/A 722M.

I. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
   1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm). Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
   1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.

2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
   1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
   2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
   3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
   1. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlaying construction and abandon remainder.
   2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
   3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 50 00

SECTION 31 63 29 - DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Dry-installed drilled piers.

1.3 UNIT PRICES

A. Unit prices are included in Section 01 22 00 "Unit Prices."

B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts and bells.
   1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
   2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

C. Trial Drilled Pier: Unit price as indicated for drilled pier, including backfilling.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.

D. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Admixtures.
   3. Steel reinforcement and accessories.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

F. Field quality-control reports.

G. Other Informational Submittals:
   1. Record drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
   1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
   1. Notify all affected parties including Owner no fewer than five (5) days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
   1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
   2. The geotechnical report is referenced elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
   1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Refer Section 03 20 00.

2.2 CONCRETE MATERIALS

A. Refer Section 03 30 00 and Structural General Notes.

2.3 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283, Grade C, or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.

B. Corrugated-Steel Pipe Casings: ASTM A 929, steel sheet, zinc coated.

2.4 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Proportion normal-weight concrete mixture as follows:
   1. As indicated in Structural General Notes.

2.5 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
   1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
   2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.

B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
   1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
   2. Remove water from excavated shafts before concreting.

D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
   1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
   2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.

E. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

F. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
   1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.

G. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.

H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
   1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
   1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete. Before placing remainder of concrete, clean surface

laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
   1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
   2. Vibrate top 60 inches of concrete.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
   1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Drilled piers.
   2. Excavation.
   3. Concrete.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
   1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.

D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94.
   1. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
   2. Concrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F and below and 80 deg F and above, and 1 test for each set of compressive-strength specimens.
   3. Compression Test Specimens: ASTM C 31; one set of four standard 6-inch x 12-inch cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.

4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.
5. If frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
6. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
    a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
11. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
2. Actual drilled-pier diameter at top, bottom, and bell.
3. Top of rock elevation.
4. Description of soil materials.
5. Description, location, and dimensions of obstructions.
6. Final top centerline location and deviations from requirements.
7. Variation of shaft from plumb.
8. Shaft excavating method.
9. Design and tested bearing capacity of bottom.
10. Levelness of bottom and adequacy of cleanout.
11. Ground-water conditions and water-infiltration rate, depth, and pumping.
12. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
13. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
14. Bell dimensions and variations from original design.
15. Date and time of starting and completing excavation.

16. Inspection report.
17. Condition of reinforcing steel and splices.
18. Position of reinforcing steel.
19. Concrete placing method, including elevation of consolidation and delays.
20. Elevation of concrete during removal of casings.
21. Locations of construction joints.
22. Concrete volume.
23. Concrete testing results.
24. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 63 29

SECTION 32 13 13
CONCRETE PAVEMENT

1. SCOPE:

This specification covers the construction of concrete pavement with or without reinforcement, with or without curbs, all as shown on the plans, on a prepared subgrade or other base material. The pavement shall be constructed in accordance with the dimensions, grades, and typical cross sections shown in the plans.

For LEED specific requirements, see section 2.15.

2. MATERIALS:

Materials shall conform to the following specifications or standards:

2.1 Cement: Cement of the type specified shall conform to requirements of the current ASTM Specifications for Portland Cement Type I, II, or III (Designation C-150), for Air Entraining Portland Cement Type IA, IIA, or IIIA (Designation C-175) or for Portland Slag Cement Type IS, or ISA (Designation C-205). Type I, IA, IS, or ISA shall be supplied unless Type II or IIA (Moderate Heat of Hydration) or Type III or III (High-Early Strength) are specified. Cement which for any reason has become partially set or which contains lumps of caked cement shall be rejected. Either packaged or bulk cement may be used.

2.2 Water: Water used in mixing or curing concrete shall be clean and free from injurious amounts of oil, acids, salt, alkali, or organic materials or other substances harmful to concrete. Water from public supplies or which is suitable for drinking is always satisfactory.

2.3 Air Entraining Agent: Air entraining admixtures shall conform to the requirements for the current ASTM Specifications for Air Entraining Admixtures for Concrete (Designation C-260).

2.4 Aggregate:

2.4.1 Coarse Aggregate: Coarse aggregate shall consist of crushed stone or gravel, and shall be clean, hard, and durable, free from excessive adherent coatings, free from salt and alkali, and when tested by standard laboratory methods, shall conform to the following requirements:

2.4.2 The maximum percentage of deleterious substances shall not exceed the following values by weight:

Removed by decantation	4%
Shale	0.25%
Clay Lumps	0.25%
Soft Fragments	3%
Other local deleterious substances, such as friable pieces	3%
The sum of the percentages of all above constituents shall not exceed	3%

2.4.3 Coarse aggregate shall have not more than 45 percent wear when tested according to AASHTO Designation T96.

2.4.4 Coarse aggregate shall conform to the grading requirements given below when tested on standard square-opening sieve, and shall be well graded within the limits specified. Aggregates of different classes shall not be mixed except on the written permission of the Engineer. Changes in the classes of aggregates being used while the work is in progress will be permitted upon due notice by the Contractor to the Engineer of his intentions and the fulfillment of the necessary requirements to comply with those specifications. Aggregates in which different size particles have become segregated due to improper stockpiling, improper handling, or for other reasons, shall, before being used, be mixed to conform to the grading requirements hereinafter specified, and shall be uniform.

Retained On:	
2-1/2" Sieve	0%
1-3/4" Sieve	0% to 20%
3/4" Sieve	25% to 65%
No. 4 Sieve	95% to 100%

2.4.5 Aggregates having different characteristics shall not be mixed either in piling or batching except by special permission from the Engineer. Aggregate shipped in dirty cars or containers or that becomes mixed with weeds, dirt, or foreign material, or that is not uniform, or the component parts of which have become segregated will be rejected. No aggregate shall be stored or dumped on the roadbed.

2.5 Fine Aggregate:

2.5.1 Fine aggregates shall consist of washed sand having clean, hard, durable, uncoated grains, free from soft or flaky particles or other injurious matter, shall be well graded from coarse to fine, and when tested by standard laboratory methods, shall meet the following requirements:

Retained On:	Percent by Weight:
3/8" Screen	0
1/4" Screen	0 - 5
20 Mesh Sieve	15 - 50
100 Mesh Sieve	85 - 100

Weight Removed by elutriation test not more than 2%.

2.5.2 When subjected to the color test for organic impurities, fine aggregate shall not show a color darker than the standard color.

2.5.3 Aggregates from different material sources, or aggregates from the same source having different grading or other physical characteristics, shall be stockpiled separately and batched independently. Aggregates shipped in dirty cars or containers, or that which becomes mixed with weeds, dirt, or other foreign material, or that which is not uniform, or the component part of which have become segregated, will be rejected. No aggregate shall be stored or dumped on

the roadbed.

2.6 Mineral Filler: The addition of stone dust and/or sand and/or crushed shell dust (oyster) of acceptable quality and cleanliness may be required as a mineral filler to improve the workability of plasticity of the concrete mixture, in amounts not to exceed 15% of the weight of the fine aggregate. When tested with standard laboratory sieves, the mineral filler shall meet the following requirements:

Passing 30 Mesh Sieve	5 - 100%
Passing 200 Mesh Sieve	50 - 100%

When a mineral filler is used, it must be batched and weighed separately.

2.7 Reinforcing Steel: Reinforcing steel, if specified, shall conform to the latest ASTM Specification, as follows:

Type	ASTM Designation
Bars and Rods	A-615, Grade 40
Steel Wire Fabric	A-185, Grade 60

Tie bars which are to be bent after one end is encased in concrete shall be structural grade.

2.8 Joints:

2.8.1 Expansion Joint Material: Filler board shall be of selected stock and of density and type of wood listed below:

a. Cypress: Clear all heart; maximum weight per cubic foot when oven dried to constant weight shall be 40 pounds.

b. Redwood: Clear all heart; maximum weight per cubic foot when oven dried to constant weight shall be 30 pounds.

2.9 Joint Sealing Compound: Sealing material shall be the hot-poured elastic type for filling all types of pavement joints and shall comply with ASTM Standard Specification D-6690, Type II or III, or as required by the Plans.

2.10 Premolded Joint Material: Premolded parting strips, when called for on the plans, shall be 3/16-inch-thick or more and of the width shown on the plans. They shall consist of strips which have been formed from layers of felt or shredded felt, cane, wood, or other suitable fibers securely bound together and uniformly impregnated with a suitable binder. They shall be of such character that they will not be permanently deformed by ordinary handling during hot weather or become hard and brittle in cold weather.

2.11 Load Transmission Devices: Load transmission devices shall be dowel type as shown on the plans and shall conform to ASTM Designation A-615, Grade 60.

2.12 Supports: Supports for reinforcing steel to be metal or plastic of approved shape and size. Space supports as directed.

2.13 Load Transfer Units: Provide polypropylene plastic, Greenstreak, Speed Load, Style No. PSD3/4X9LT or equal. Unit shall be securely attached to the expansion joint filler board.

2.14 Materials for Curing Concrete:

2.14.1 Burlap shall at time of use be in good condition, free from holes, dirt, clay, or any other substance which would have a deleterious effect upon concrete. Burlap shall be of such quality that it will absorb water readily when dipped or sprayed, and shall weigh not less than 7 ounces per square yard when clean and dry.

2.14.2 Waterproof paper for curing concrete shall conform to the current ASTM or AASHTO Specifications for Waterproof Paper for Curing Concrete (C-171 and M-139, respectively).

2.14.3 Membrane curing compounds shall be the white pigmented type and conform to the requirements for the current AASHTO Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete (Designation M-148).

2.15 Solar Reflectance Index

2.15.1 Solar Reflectance index shall meet a minimum rating of 29 to meet LEED criteria (If applicable).

a. Emissivity (Emittance) shall have a rating between 0.85 and 0.95 as calculated according to ASTM E 408 or ASTM C1371
b. Reflectance shall have a minimum rating of 0.30 as calculated according to ASTM E903, ASTM E1918 or ASTM C 1549.

3. MIXING AND PLACING:

Scales used shall be accurate to within 1/2 of 1%. One sack of cement shall weight 94 pounds net.

3.1 Proportioning:

3.1.1 Contractor shall assume responsibility of design of concrete mixture. Furnish statement giving proportion of materials in mixes. Furnish commercial laboratory reports showing that proportions and materials selected will produce laboratory mixed concrete of specified quality and having strength of 10 percent higher than that specified.

3.1.2 Concrete mix shall be uniform and workable containing not less than 5-1/2 sacks of cement per cubic yard with not more than 6 gallons of water, net per sack of cement. Addition of mineral filler may be required as hereinafter provided to improve workability or elasticity of concrete.

3.1.3 Add air entraining agent to concrete to produce same effect as could be obtained by use of "Air Entrained Portland Cement", ASTM C-175-65. Use amount such as will effect entrainment of 3% to 5% of air by volume of concrete. Add material to batch in solution in portion of mixing water. Batch this solution by means of mechanical batcher capable of accurate measurement and in such

manner as will insure uniform distribution of agent throughout batch during specified mixing period.

3.1.4 Retardant required when temperature exceeds 85% F., proportion as recommended by manufacturer. Retardant shall be of the same brand as air entraining agent. Add material to batch in solution in portion of mixing water. Batch this solution by means of mechanical batcher capable of accurate measurement and in such manner as will insure uniform distribution of agent throughout batch during specified mixing period.

3.1.5 Amount of coarse aggregate (dry-loose volume): 85% per cubic foot of concrete, maximum.

3.1.6 Net amount of water: amount added at mixer, plus free water in aggregate and minus absorption of aggregate based on 30-minute absorption period. No water allowance will be made for evaporation after batching.

3.1.7 Concrete mix will be designed with intention of producing concrete which will, at age of 7 days, have flexural strength of 500 pounds per square inch, or a compressive strength at 28 days of 3500 psi.

3.1.8 Settlement of concrete shall be not less than 1-1/2 inch, nor more than 4 inches when gauged by Standard Slump Test.

3.2 Testing Concrete:

3.2.1 Laboratory Services: Owner will approve the commercial laboratory and payment for services shall be as outlined in the Special Conditions, normally paid for by the Contractor.

3.2.2 Duties: Laboratory will inspect and test materials entering concrete and design concrete mixes to meet specified strengths, uses, and finishes; analyze aggregate for quality, durability, grading, and free water content; take representative specimens of ingredients and mixes; make test beams and measure flexural strength of same; check moisture content of aggregates and control mix subject to approval.

3.2.3 Test Procedures: Laboratory will make tests in conformance with current standard test procedures of ASTM.

3.2.4 Test Reports: Laboratory will furnish written reports covering results of tests and inspections made. Reports will be made promptly to Engineer and Contractor.

3.2.5 a. Test Beams: Two beam specimens for flexural strength test will be made for each 500 square yards, or less, or pavement that is placed in one day. Beams shall be tested at age of 7 and 28 days. Loading shall be standard third point loading. Beams will be made, cured, and tested using applicable ASTM Standards for sampling and testing.

b. Test Cylinders: Four (4) concrete test cylinders will be made for each 500 square yards, or less, of pavement that is placed in one day. Cylinders shall be tested at age of 7 and 28 days. Cylinders will be made, cured, and tested

in accordance with ASTM Standard, current.

3.2.6 Yield: Yield test made in accordance with ASTM C 138-63, shall be made for purpose of determining cement content per cubic yard of concrete. If such cement content is found to be less than that specified per cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.

3.2.7 Core Samples: Concrete pavement will be core drilled at locations designated and at those locations pavement will be measured for thickness. Minimum of one core will be drilled for each 500 square yards of pavement. At age of 28 days, each core may be tested for compressive strength according to methods of the ASTM C-42. Twenty-eight-day compressive strength of each core tested shall not be less than 3500 pounds per square inch.

3.3 Equipment: Equipment necessary for mixing, laying, and finishing of concrete pavement shall be in first class working conditions and shall be inspected and approved before paving operations will be permitted.

3.3.1 Scales:

a. All materials shall be separately and accurately measured by weight, using standard weighing devices attached to a standard batching plant approved by the Engineer. A sack of cement packed by the manufacturer and weight 94 pounds shall be considered one cubic foot.

b. Scales shall be of the beam type or of the springless dial type. The beam shall be equipped with a springless dial indicator showing at least 100 pounds over or under the required weight. All scales or dial indicators shall be graduated in not more than 5-pound increments.

c. Scales not accurate to within a tolerance of four pounds per 1,000 pounds of net load in the hopper shall not be used.

3.3.2 Mixer:

a. Capacity of not less than 14-S mixer as rated by Mixer Manufacturer's Bureau of A.G.C. and speed regulator to hold mixer to its normal speed of revolution. Equip mixer with automatic attachment for satisfactorily timing mix and locking discharging device to prevent discharging of mixer until all materials have been mixed together for minimum time required. This attachment: operate independently of the drum and have bell in operation at all times, indicating completion of mixing time, that can be plainly heard 50 feet from mixer.

b. Equip mixer with water measuring device to measure water within one percent to total amount required. Construct measuring drum so that it will open to atmospheric pressure when measured amount of water is within same, and so placed and constructed that single batch of water can be discharged into calibrated tank or weighing device (for checking accuracy) attached to mixer, without seriously delaying paving operations. Check this

water measuring device daily.

3.3.3 Batch Trucks: Batch trucks for the transportation of measured materials from the batching plant to the mixer shall be tight and so covered as to prevent excessive evaporation of moisture or any loss of material.

3.3.4 Vibrators: Mechanically operated synchronized vibratory units mounted on a tamping bar to ride on the forms. Hand manipulated mechanical vibrators. Frequency of the vibratory units shall be to provide maximum consolidation of concrete without segregation of aggregate.

3.3.5 Machine Finisher: The transverse finishing machine shall be provided with two screeds accurately adjusted to the crown of the pavement, shall be power driven and mounted in substantial frame equipped to ride on the forms, and shall be so designed and operated as to strike off and consolidate the concrete. Finishing machine shall have rubber tires if it operates on concrete pavement.

3.3.6 Hand Finishing:

a. For hand finishing, provide strike template made of 4" x 10" lumber, at least 2 feet longer than width of pavement to be finished. Make strike template so it will leave sufficient amount of concrete above elevations required on finished surface to allow for tamping. Concrete pavement shall be consolidated by an approved mechanical vibratory unit, designed to vibrate the concrete internally. A vibratory member shall extend across the pavement practically to, but shall not come in contact with, the side forms, and shall be equipped with synchronized vibratory units.

b. Also provide longitudinal float with wood face of approved design, 14 feet in length, or approved type of mechanical longitudinal float with not less than 10 feet longitudinal float or screed. Provide two bridges for operation of longitudinal float, bridge for finishing expansion and dummy joint, and necessary edging and finishing tools to complete pavement slab as shown and specified.

3.3.7 Belting: Belt for finishing slab shall be canvas or canvas-rubber composition, 2 to 4 ply, not less than 8" nor more than 10" wide, and at least 2 feet longer than the width of pavement.

3.3.8 Subgrade Planer and Template:

a. Subgrade planer shall be provided, mounted on visible rollers riding on the forms, and having adjustable cutting blades which shall trim the subgrade to the exact section shown on the plans. The planer frame shall be heavy enough to remain on the forms at all times, and shall be of such strength and rigidity that, under a test made by changing the support from the wheels to center, shall not develop a deflection of more than 1/8 inch. Tractive power equipment used on the subgrade to pull the planer shall not be such as to produce ruts or indentations in the subgrade.

b. A template for checking the contour of the subgrade shall be provided and

operated by the Contractor. The template shall rest upon the side forms and shall be of such strength and rigidity that under a test made by changing the support to the center, it shall not show a deflection of more than 1/8 inch. It shall be provided with accurately adjustable rods projecting downward to the subgrade at 1 foot intervals, and these rods shall be adjusted to the required cross-section of the bottom of the slab when the template is resting upon the side forms.

3.3.9 Forms: Side forms for concrete pavements construction on lime stabilized subgrade shall be metal forms. Side forms for concrete pavements constructed on natural subgrades may be metal or wood. Metal forms shall be of approved shape and section. Wood forms shall be of 2x material. The preferred depth of the forms shall be equal to the required edge thickness of the pavement. Forms with depths greater or less than 1 inch of pavement thickness may be used. Metal forms with less depth than pavement thickness will be brought to the required depth by securely attaching wooden planks of approved section and size to the bottom of the form. Use form section at least 10 feet in length, and provide for staking in position with not less than three pins or stakes. Use forms of adequate strength to withstand machine loads without visible springing or settlement. Use forms free from warps, bends, and kinks, and sufficiently true to provide a straight edge on the concrete. The top of each form section, when tested with a straight edge, shall conform to the requirements specified for the surface of the completed pavement. Use flexible or curved forms of wood or metal of proper radius for curves of 100 feet radius or less.

a. For all private site work, wood forms are an acceptable substitute for metal forms.

3.4 General Construction Requirements:

3.4.1 Subgrade: The bottom on the excavation for the pavement or top shall conform to the lines, grade, and cross-sections shown on the plans.

All soft and yielding material and other portions of the subgrade shall be removed as directed and replaced with suitable material placed and compacted as specified herein.

The subgrade shall have uniform density and be compacted at or slightly above the optimum moisture content. In the absence of standard testing, a reasonable evaluation of moisture content may be made by squeezing a ball of damp soil in the hand. If the ball is so dry that it crumbles easily, additional water should be mixed into the soil. If it is so wet that free water comes to the surface when kneaded, the subgrade should be permitted to air out before final rolling. The subgrade shall be thoroughly compacted with suitable equipment.

All sewer trenches and structure excavation shall be backfilled to natural or finished grade as soon as conditions permit. All backfill shall be compacted with mechanical tampers in layers of not over 6 inches loose material. Vibratory compactors that are small enough to operate within the limited area are very satisfactory.

The subgrade shall be finished in an acceptable condition for at least one day's progress in advance of the pavement construction at all times.

Concrete shall not be placed upon a soft, spongy, or frozen subgrade or other subgrade, the stability of which is, in the opinion of the Engineer, unsuitable for the placement of concrete.

The subgrade shall be in a moist condition at the time the concrete is placed. It shall be thoroughly wetted a sufficient time in advance of the placing of the concrete to ensure that there will be no puddles or pockets or mud when the concrete is placed, but shall not be allowed to dry out before the concrete is placed.

Immediately prior to placing the concrete, the subgrade shall be tested for conformity with the cross-section shown on the plans by means of an approved template riding on the side forms. If necessary, material shall be removed or added, as required, to bring all portions of the subgrade to the correct elevation. It shall then be thoroughly compacted and again tested with the template. Concrete shall not be placed on any portion of the subgrade which has not been tested for correct elevation. The subgrade should also be cleared of any loose material which may have fallen on it.

3.4.2 Protection of Subgrade: The finished subgrade shall be maintained in a smooth and compacted condition until the concrete has been placed.

The mixer, ready-mix trucks, or other equipment shall not operate between the forms in the paving lane unless conditions of the job will not permit operation from the shoulder or outside the lane.

If it is necessary to operate trucks between the forms and the trucks cause rutting or displacement of the subgrade material, either lighter trucks shall be used or suitable runways shall be provided. The Contractor shall re-roll or hand tamp the subgrade to correct any ruts or other objectionable irregularities which may have been caused by the trucking of materials.

A berm shall be graded between the curb and sidewalk, or property line where there are no existing sidewalks, in a neat, workmanlike manner. All excess concrete and debris shall be removed from the excavation behind the curb line before backfilling.

3.4.3 Forms:

a. General: Forms shall be made of metal (wood is optional for private site work) and shall have a depth equal to or greater than the prescribed edge thickness of the pavement slab, except when the curb form is added after machine finishing. They shall have a base width of not less than eight (8) inches for all forms eight (8) inches or more in height. All side forms less than eight (8) inches in height shall have a base width of not less than six (6) inches. The minimum length of each section of form used shall be ten (10) feet. Each section of form shall be straight, free from bends or warps.

The maximum deviation of the top surface of any section shall not exceed one-eighth (1/8) inch, or the inside face not more than one-fourth (1/4) inch from a straight line. The method of connection between section shall be such that the joint thus formed shall be free from movement in any direction. Forms shall be of such cross-section and strength and so secured to resist the pressure of the concrete when placed, and the impact and vibration of any equipment which they support, without springing or settlement.

Each ten (10) feet length of form shall have at least three (3) form braces and pin sockets which shall be spaced at intervals of not more than five (5) feet having the end brace and socket not more than six (6) inches from the end of the form. Approved flexible forms shall be used for construction where the radius is 150 feet or less.

b. Setting Forms: The subgrade under the forms shall be compacted and cut to grade so that the form when set will be uniformly supported for its entire length at the specified elevation. Forms shall be joined neatly and in such a manner that the joints are free from play or movement in any direction. Forms shall be set, as herein specified, for at least one day's construction ahead of the actual placing of the concrete. The supply of forms shall be sufficient to permit their remaining in place for at least 12 hours after the concrete has been placed. All forms shall be cleaned and oiled each time they are used.

c. Grade and Alignment: The alignment and grade elevations of the forms shall be checked by the Contractor and the necessary corrections made by the Contractor immediately before placing the concrete. When any form has been disturbed, or any subgrade thereunder has become unstable, the form shall be reset and rechecked.

3.4.4 Placing Concrete: The concrete shall be mixed in quantities required for immediate use and shall be deposited on the subgrade to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. The concrete shall be placed as uniformly as possible in order to minimize the amount of additional spreading necessary. While being placed, the concrete shall be spaded or vibrated and compacted with suitable tools so that the formation of voids or honeycomb pockets is prevented. The concrete shall be especially well spaded or vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along the outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been brought to the required grade and alignment.

3.4.5 Cold Weather Concreting: Except by specific written authorization, concreting shall cease when the descending air temperature in the shade and away from artificial heat falls below 45□ F. It shall not be resumed until the ascending air temperature in the shade and away from artificial heat rises to 45□ F.

3.4.6 Consolidating and Finishing:

a. General: The pavement shall be struck off and consolidated with a mechanical finishing machine or by hand-finishing methods. When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the exact elevation as shown on the plans.

A depth of at least 2 inches of concrete shall be carried in front of the strike-off screed for the full width of the slab, whenever the screed is being used to strike off the pavement. The finishing machine shall be provided with a screed which will consolidate the concrete by pressure. The concrete shall, through the use of this machine, be brought to a true and even surface, free from rock pockets, with the fewest possible number of passages of the machine. The edge of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb. Hand finishing tools shall be kept available for use in case the finishing machine breaks down.

When hand finishing is used, the pavement shall be struck off and consolidated, by a vibrating screed to the exact elevation as shown on the plans. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off; it shall not be allowed to idle on the concrete.

b. Longitudinal Floating: After the concrete has been struck off and consolidated, it shall be further smoothed by means of a longitudinal float. If a mechanical longitudinal float is not used, a longitudinal hand float shall be operated from foot bridges spanning the pavement and shall be worked with a wiping motion, parallel to the pavement centerline, and passing from one side of the pavement to the other. Movement ahead along the centerline of the pavement shall be in successive advances of not more than 1/2 of the length of the float. The float shall not be less than 12 feet in length and 6 inches in width and shall be properly stiffened and provided with handles at each end.

c. Scraping: After the passage of the longitudinal float, the pavement shall be scraped with a straightedge 10 feet long, equipped with a handle to permit it to be operated from the edge of the pavement. The straightedge shall be operated so that any excess water is removed from the surface of the pavement.

d. Straightedging: After the longitudinal floating and scraping have been completed and any excess water removed, but while the concrete is still plastic, the slab surface shall be tested for smoothness with a 10-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be placed on the surface parallel to the centerline of the pavement and at not more than 5 feet intervals transversely. After each test, the straightedge shall be moved forward one-half its length and the operation repeated. When irregularities are discovered, they shall be corrected by adding or removing concrete. All disturbed placed shall be floated with a wooded float not less than 3 feet long and not less than 6 inches wide, and again straightedged. The pavement surface shall have no

depression in which water will stand.

The use of the long-handled wood floats shall be confined to a minimum. They may be used behind the longitudinal float to correct surface unevenness not taken care of by the longitudinal float, but shall not be used to float the entire surface of the pavement in lieu of or supplementing the use of the longitudinal float.

e. Edging: Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans.

f. Final Surface Finish: A burlap drag shall be used as the final finishing method. The drag shall be at least 3 feet in width and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the surface of the pavement and dragged forward in the direction in which the pavement is being laid. The curb shall have the same final finish as the pavement.

The final surface of the concrete pavement and curb shall have a uniform gritty texture free from excessive harshness and true to the grades and cross-section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

3.4.7 Curing:

a. General: Concrete shall be cured by protecting it against loss of moisture, rapid temperature change, and from rain, flowing water, and mechanical injury for a period of not less than 5 days from the beginning of the curing operation. Moist curing, water-proof paper, white polyethylene sheeting, liquid membrane compound or a combination thereof may be used for curing. Immediately after finishing operations have been completed, the entire surface of the newly laid concrete shall be covered by the curing medium which is applicable to local conditions and approved by the Engineer. The edge of concrete slabs exposed by the removal of forms shall be protected immediately to provide these surfaces with continuous curing treatment equal to the method selected for curing the slab surface and to prevent injury to pavement edges.

The use of a covering material which contains or becomes contaminated with sugar in any form, tannic acid, or any other substances considered detrimental to Portland Cement will not be permitted. The initial curing medium shall be effective and shall be applied so as to prevent checking, cracking, and the appearance of dry spots in the surface of the concrete. The Contractor shall have the equipment needed for adequate curing at hand and ready to install before actual concrete placement begins. In all cases in which the curing medium requires the use of water, the curing shall have prior right to all water supply. Failure to provide sufficient cover material of the type selected, failure to maintain saturation for the entire curing period in the most-curing methods, lack of water to adequately care for both curing and other requirements, or other failures to comply with curing requirements

shall be cause for immediate suspension of concreting operations.

b. Moist Curing: Moist curing shall be accomplished by covering of burlap, cotton mats, or other approved fabric mat, used singly or in combination.

Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the pavement surface for the duration of the moist curing period. Other fabric mats shall conform in design and shall provide a curing medium at least equal to cotton mats. Cotton mats, other fabric mats, and burlap strips shall be furnished in the widths or lengths, after shrinkage, required to cover the entire width and edges of the pavement lane. Mats or burlap shall be lapped at joints between adjacent sheets to prevent drying of this location. Moist curing when used as initial curing shall be contained for not less than 24 hours.

c. Waterproof Paper Curing: The surface of the concrete shall be wetted with a fine spray of water and then covered with the waterproof paper. The paper shall be in pieces large enough to cover the entire width and edges of the slab and shall be lapped not less than twelve (12) inches. Paper shall be adequately weighted to prevent displacement or billowing due to wind. Paper folded down over the side of the pavement edges shall be secured by a continuous bank of earth. Tears or holes appearing in the paper during the curing period shall be immediately repaired.

d. White Polyethylene Sheeting: White polyethylene shall meet the specifications previously mentioned.

e. Liquid Membrane Curing Compound: Pigmented liquid membrane curing compound shall meet the specifications under Paragraph 2.14.6. The curing compound must be applied to cover the surface specifications under previously mentioned paragraphs. The curing compound must be applied to cover the surface completely and uniformly at a rate which will achieve the performance requirement specified in AASHTO Specifications M-148. This method of curing shall be applied immediately behind the final finishing operation or after the initial curing when a combination of methods are used. Failure to provide complete and uniform coverage at the required rate will be cause for discontinuance of this method of curing and the substitution of one of the other approved methods. The compound shall be kept agitated to prevent the pigment from settling. Special care shall be taken to apply the curing compound to the pavement edges immediately after the forms have been removed.

3.4.8 Joints:

a. General: Longitudinal and transverse joints shall be constructed as shown on the plans.

Longitudinal joints are those joints parallel to the lane of construction. They may be either intermediate center joints or the construction joints between construction lanes.

Transverse joints shall be contraction joints or construction joints. Construction joints are put in transversely wherever construction operations require them.

Expansion joints may be either longitudinal or transverse. They are used only where specifically shown on the plans.

The edges of the pavement and those joints where such edging is shown on the plans shall be rounded with an edger having a radius of not larger than 1/8 inch. Transverse joints, except keyed and tied construction joints, shall be continuous across the entire paved area, including the curb.

b. Transverse Joints: Transverse joints shall be contraction, expansion, or construction joints. Contraction and expansion joints shall be placed as indicated on the plans and construction joints whenever construction may require them. They shall make a right angle with the centerline of the pavement and surface of the subgrade.

c. Transverse Expansion Joints: Expansion joints where shown on the plans shall conform to the specification previously mentioned. They shall extend the entire width of the pavement and from the subgrade to one (1) inch below the surface of the pavement. They shall be of the dimensions and spacing as shown on the plans. The filler shall be held accurately in place during the placing and finishing of the concrete by a bulkhead, a metal channel cap or other approved method.

Under no circumstances shall any concrete be left above the expansion material or across the joint at any point. Any concrete spanning the ends of the joint next to the forms shall be carefully cut away after the forms are removed.

Before the pavement is opened to traffic, the groove above the filler shall be cleaned and sealed with specified joint sealing material covered previously.

d. Transverse Contraction Joints: Transverse contraction joints shall be of the sawed, formed dummy groove or premolded strip type.

e. Transverse Sawed Contraction Joints: When transverse contraction joints are to be formed by sawing, care must be taken to saw the grooves soon after placing to prevent the formation of cracks due to contraction of the slab. All transverse joints shall be sawed at least 1/4 of the slab depth.

f. Transverse Formed Dummy Groove Joints: Transverse dummy groove joints shall be formed by a groove or cleft in the top of the slab of the dimensions shown on the plans. The groove made in the plastic concrete by a suitable tooling device, shall extend vertically downward 1/4 of the slab depth from the surface and shall be true to line.

g. Transverse Premolded Strip Joints: Transverse premolded strip joints shall be of the proper dimensions as shown on the plans. The premolded filler is placed in a vertical groove formed to receive it. The top of the filler should be flush with the pavement surface.

h. Transverse Construction Joints: Transverse construction joints of the type shown on the plans shall be placed whenever the placing of concrete is suspended for more than 30 minutes. A butt type joint with dowels shall be

used if the joint occurs at the location of a contraction joint. Keyed joints with tiebard are used if the joint occurs at any other location.

i. Dowels: If joints are to be equipped with dowels they shall be of the dimensions and at the spacing and location indicated on the plans. They shall be firmly supported in place, accurately aligned parallel to the pavement grade and the centerline of the pavement by means of a dowel support which will remain in the pavement and will insure that the dowels are not displaced during construction. One-half of each dowel shall be painted and greased and in expansion joints one end shall be equipped with a tight-fitting sleeve of the dimensions shown on the plans conforming to specifications previously mentioned.

j. Longitudinal Joints: Longitudinal joints shall be placed as shown on the plans. They shall be of the sawed, dummy groove, premolded strip, or the keyed construction type. Joints between construction lanes shall be the keyed construction type.

k. Longitudinal Center Joint: Longitudinal center joints shall be of the sawed, formed dummy groove or premolded strip type.

l. Sawed Longitudinal Center Joints: Sawed longitudinal center joints shall be sawed grooves made with a concrete saw after the concrete has hardened. The saw cut shall be at least 1/4 of the slab depth. The joint may be sawed at any time prior to the time the pavement is open to traffic. These joints are otherwise formed in the same manner as the transverse sawed joints previously mentioned.

m. Longitudinal Formed Dummy Groove Joints: Longitudinal dummy groove joints are formed in the same manner described for Transverse Premolded Strip Joints previously mentioned.

n. Longitudinal Premolded Strip Joint: Longitudinal premolded strip joints are formed in the same manner described for Transverse Premolded Strip Joints previously mentioned.

o. Longitudinal Premolded Strip Joint: Longitudinal construction joints (i.e., joints between construction lanes) shall be of the dimension shown on the plans. The key shall be constructed by placing a deformed metal plate against the form when the first lane adjacent to the joint is placed. This metal plate shall be removed with the form. When placing the second slab, care must be taken that no concrete is left to overhang the lip formed in the first slab by the edging tool.

p. Tiebars: Tiebars or tiebolts when shown on the plans shall be of deformed steel and of the dimensions and at the spacing specified. Tiebars shall be firmly supported by subgrade chairs or so installed as not to be displaced during construction operations.

q. Joint Sealer: After the curing period, all sawed and dummy groove joints in the pavement shall be cleaned and sealed with material meeting the requirements previously mentioned. All foreign material, joint sawing residue, dirt and curing membrane shall be removed. Joints shall be slightly underfilled (about 1/4") to prevent extrusion of sealer. Any excess material

should be removed from the pavement surface as soon after sealing as possible.

r. Integral Curb Joints: In the construction of transverse joints of concrete integral curb pavement, special care must be taken to see that all transverse joints extend continuously through the pavement and the curb.

3.4.9 Protection and Opening to Traffic: Street closure signs to be erected at least five (5) days prior to the work commencing. The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Owner. Traffic shall be excluded from the pavement by erecting and maintaining barricades and signs until the concrete is at least 7 days old, or for a longer period, if so directed by the Engineer. The pavement shall not be used at any time within this period for transporting or operating equipment. As a construction expedient, the subgrade planer, concrete finishing machine, and similar equipment may be permitted to ride upon the edges of previously constructed slabs provided the concrete is more than 72 hours old, and the equipment has rubber-tired wheels to run on the finished slab.

Mixer or ready-mix trucks shall not be permitted to operate from previously paved lanes until the pavement is at least seven days old or a flexural strength of 550 psi or 3000 psi is attained.

4. OPTIONAL CONSTRUCTION EQUIPMENT:

4.1 Slip-Form Paver: In lieu of the construction methods described in the preceding section of the specifications, the Contractor may use a slip-form paver. When the slip-form paver is used, all reference in the preceding sections of this specification referring to forms shall be deleted.

Slip-form pavers shall be equipped with vibratory and tamping bar assemblies which are effective over the full width of the pavement. The paver shall also have a metal float with a bulldozed front end for the full width of the pavement, except curbs, which will extrude the concrete under pressure.

Behind the float shall be a rubber belt, mechanically operated and with a lateral movement of 4 to 8 inches. The curb shall be formed by extrusion plates or mules mounted at the rear of the machine. The requirement for longitudinal floating shall be deleted.

4.2 Subgrade: The subgrade shall be brought to the proper grade and cross-sectioned by means of a properly designed and operated machine. The subgrade shall comply with applicable sections of this specification. If any traffic is allowed to use the prepared subgrade, some device, satisfactory to the Engineer, shall be provided for checking and correcting the subgrade immediately ahead of placing the concrete. The subgrade work, especially the path on which the tracks of the paver ride, must be done carefully and accurately as its degree of precision greatly affects the resulting smoothness of the pavement surface.

4.3 Placing: Concrete shall be of uniform slump and adequately supplied in front of the paver. The rate of progress shall be controlled so that the forward movement of the paver will be as nearly contiguous as practicable. If it is necessary to stop the forward movement of the paver, the vibrator and tamping elements shall also be stopped immediately. Care must be taken to see that a sufficient supply of concrete passes around

the float and the belt along the form line to form the integral curb where shown on the plans.

4.4 Final Finishing: Final finishing operations shall conform to the applicable sections of this specification.

END OF SECTION

SECTION 32 13 14 – PEDESTRIAN CONCRETE PAVING

PART 1 - GENERAL:

1.1 SUMMARY:

A. Section Includes:
1. Concrete bands, sidewalks, and pavements.
2. Sawcut jointing patterns
3. Expansion joints

1.2 REFERENCES:

A. American Concrete Institute (ACI)

1.	211.1-77	Recommended Practice for Selecting Proportions for Normal Weight Concrete.
2.	214-77	Recommended Practice for Evaluation of Compressive Test Results of Field Concrete
3.	305-73	Recommended Practice for Hot Weather Concreting.
4.	306-66	Recommended Practice for Cold Weather Concreting.
5.	347-68	Recommended Practice for Concrete Formwork.

B American Society for Testing and Materials (ASTM)

1.	A-82-76	Cold Drawn Steel Wire for Concrete Reinforcement.
2.	A615-78	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3.	C33-78	Concrete Aggregates.
4.	C94-78	Ready Mixed Concrete.
5.	C150-78a	Portland Cement.
6.	C260-77	Air Entraining Admixtures.
7.	C330-77	Lightweight Aggregates for Structural Concrete.
8.	C494-79	Chemical Admixtures for Concrete.
9.	D1751-73	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and resilient Bitumens Type).

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

C. Testing Laboratory Services

1. Perform all required tests and coordinate all efforts with the designated testing laboratory.

2. Cooperate with testing laboratories to permit proper testing and inspection procedures.

D. Source Limitations:

1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.4 SUBMITTALS:

A. Forms: Submit Data with complete illustrations and/or descriptions for the following:

1. Inserts, anchors, sleeves and other embedded items.

2. Expansion joint fillers.

3. Vapor Barrier

B. Cast-In-Place Concrete:

1. Mix Designs:
   a. Mix Designs for each type of concrete

2. If mix designs are based upon field experience with materials to be used, submit substantiating data at time of submitting mix designs. If suitable field performance data cannot be provided, submit laboratory confirmatory test results upon each proposed mix design. Use only mix designs accepted in writing by Owner’s representative.

3. Product Data: Submit to Owner’s representative for each mix design:
   a. Certified mill reports on cements.
   b. Certified sieve analysis on aggregates.
   c. Cement manufacturer's name and brand name.
   d. Manufacturer's name and brand names of materials listed as products of more than one approved manufacturer.

4. Truck Delivery Tickets: Include on each ticket:
   a. Certification required by ASTM C94.
   b. Type and brand name of cement.
   c. Amount of cement, in pounds.

d. Total amount of water, in gallons.
e. Maximum size aggregate.

C. Shop Drawings: Submit six (6) copies of sub-slab shop drawings indicating expansion joint layout. Layout shall be submitted in conjunction with granite shop drawings. Expansion joints shall align accordingly.

D. Samples: Approved samples shall be the standards for finishes in concrete work.

1. Flatwork: Provide 5’ x 5’ samples of each mix and finish specified until approved by Landscape Architect. Samples shall be representative of the finish concrete and shall include, but not limited to; expansion joints, control joints, saw cut joints, patterning, finish, and color.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Store new and reusable form lumber and form plywood under heavy waterproof coverings or where well protected from inclement weather.

B. Stack oiled form plywood on sticking to permit proper ventilation between uses.

C. Handle and store metal forms in such manner as to prevent damage by denting, warping, twisting and rusting.

D. Deliver reinforcing to site in easily handled bundles with identification tags securely wired into place. Store reinforcing to prevent damage and protect from corrosion and deformation.

1.6 PROJECT CONDITIONS:

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.7 GENERAL REQUIREMENTS:

A. All concrete work shall be true to line and grade as indicated on the drawings. The Contractor shall be responsible for proper drainage, without birdbaths, on all concrete paving surfaces. Any discrepancies or omissions on drawings, or conditions on the site, which prevent this Contractor from providing proper drainage shall be brought to the attention of the Owner’s representative in writing for correction or relief before work proceeds.

B. Surface Tolerance: Finished paving surfaces shall not vary more than 1/4" inch measured with a 10' metal straight edge, except at grade changes. No birdbaths or other surface irregularities will be permitted. Correct irregularities as directed.

1.8 ENVIRONMENTAL CONDITIONS:

A. Observe provisions of ACI-305 when ambient temperature is 90 degrees F. and greater.

B. Observe provisions of ACI-306 when ambient temperature is 40 degrees F. and less.

PART 2 – PRODUCTS

2.1 PORTLAND CEMENT:

A. Shall conform to current requirements of ASTM Designation C150, Type I or II cement.

2.2 COARSE AGGREGATE:

A. ASTM C - 33 ; 1”-3/8” limestone.

2.3 FINE AGGREGATE:

A. Sand shall be clean, hard and durable with uncoated grains free from injurious amounts of silt, loam clay or other deleterious matter, conforming to ASTM C33, grade in siize from coarse to fine with 95-100% by weight passing a $4 sieve, 45-70% passing a #16 sieve, 15-30% passing a #50 sieve and 3-8% passing a #100 sieve

2.4 WATER:

A. Provide clean, potable, concrete mixing water free from injurious amounts of salts, oils, acids, alkalis, organic materials or other deleterious matter.

2.5 AIR ENTRAINMENT:

A. Air-entraining admixture shall conform to ASTM C260.

2.6 WATER REDUCING AGENTS, RETARDERS, ACCELERATORS:

A. ASTM C494: Water reducing, normal setting admixture: Type A. Water reducing, retarding admixture: Type D.

2.7 VAPOR BARRIERS:

A. Vapor Barrier (Under all slabs) shall comply with ASTM E1745 Class A, maximum WVTR 0.008, minimum 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.8 REINFORCING:

A. Reinforcing Bars: ASTM A615, Grade 60, deformed billet-steel, clean and free from rust, scale, or coating that will reduce bond.

B. Welded Wire Fabric: Not acceptable.

C. Cold Drawn Steel Wire: ASTM A82.

D. Bar Chairs: 16 gauge galvanized steel wire, with 3" x 3" base, or solid plastic of proper sizes and design to properly support and position reinforcing steel.

2.9 METAL DOWELS:

A. ASTM A36.

2.10 EXPANSION JOINT MATERIALS:

A. Premolded Joint Filler: To be "Sonoflex-F", a closed cell plastic joint filler, as manufactured by Sonneborn-Contech, Building Products Division, Contech, Incorporated, or approved equal.

B. Joint Sealant: To be "Sonolastic Sealant Two-Part" as manufactured by Sonneborn-Contech, Building Products Division, Contech, Incorporated, or approved equal. Color shall match adjacent concrete work.

C. ½” thick Asphalt saturated fiber expansion joint filler: Preformed with dowels as provided by Contractors Paving Supply in Stafford, Texas or approved equal.

D. Metal Screed Key joints: As indicated on the drawings as provided by Sheplers, Houston, Texas or approved equal

E. All expansion joint material shall be 1/2” thickness.

2.11 CURING MEMBRANE:

A. Submit a manufacturer of a spray on curing membrane to be used on all exposed concrete surfaces for approval. Conform to ASTM 309.
B. Select a fugitive color for above
C. In lieu of above, submit a plan for slow curing all concrete for approval by the Owner’s Representative

2.12 WOOD FORMS:

A. Form Lumber: Number 2 Southern pine or Number 2 Douglas Fir-Larch, surfaced four sides; true and straight members free from cupping, warping, loose knots, excessive checking and other structural defects.

B. Moldings and Chamfer Strips: "C-Select" or "Finish" Southern pine, straight, sound, and free of knots and other defects.

C. Used form materials may be reused provided that they are thoroughly cleaned and acceptable finishes can be produced.

2.13 METAL FORMS:

A. Heavy gauge steel of sufficient strength to prevent undue deflection, properly braced. Use only materials with smooth and regular contact surfaces, free from dents and irregularities that affect regularity and finish surface of concrete.

PART 3 - EXECUTION

3.1 DESIGN OF MIXES AND PROPORTIONING:

A. Proportioning and mixing of cement, aggregate, admixture and water to attain required plasticity and strength shall be in accordance with ACI-304.

B. Concrete Mixture: Concrete mixtures shall be designed by an approved commercial testing laboratory at no expense to the Owner, using approved materials furnished by the Contractor to obtain a minimum compressive strength of 4,000 pounds per square inch at 28 days of age and an air content by volume of 6% plus or minus 1.0 percent. The slump of the concrete shall be not more than 4".

3.2 SETTING FORMWORK:

A. Forms shall be constructed accurately to dimensions, plumb and true to line and grade. Forms shall be substantial, mortar tight and braced, and tied so as to maintain position and shape during placing of reinforcing and concrete. Wavy surfaces and bulged walls or slab surfaces resulting from settlement or springing of formwork will not be acceptable.

B. Do not re-use forms for exposed concrete surfaces. Coat all wood forms with form oil or release agent before pouring. Release agent shall be required on form surfaces where concrete is exposed to view in finished work.

C. Forms shall be constructed and assembled in such a manner that construction joints shall occur at approved locations.

D. Care shall be taken in all details of forming, setting, reinforcing, mixing and placing all concrete exposed in finish work to obtain smooth, even surfaces of dense concrete, and clean sharp inside and outside corners, except where tooled corners are indicated. Use of form oil will be required to prevent concrete from bonding to form.

E. Forms shall be carefully observed and checked for alignment and level as the work proceeds. All needed adjustment or additional bracing shall be done promptly.

F. Forms shall remain in place long enough to allow concrete to set properly and the Contractor shall assume all responsibility for removing same.

3.3 VAPOR BARRIER

A. Plastic Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturers recommended tape.

B. Granular Course: Cover vapor barrier with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

3.4 PLACING REINFORCEMENT:

A. Place all reinforcement as shown on drawings. Place accurately and securely fasten and support reinforcement to prevent displacement before or during pouring. Support bars and/or wire mesh with suitable reinforcing chairs.

B. Do not heat bars for bending or straightening. Do not tack weld bars.

C. Clean, bend and place reinforcement in accordance with current requirements of the ACI Manual of Concrete Practice.

D. Reinforcement Splices:

1. Reinforcing bars - 24 bar diameter minimum, except as otherwise noted.

3.5 PLACING CONCRETE:

A. Concrete shall be deposited so as to require as little rehandling as practicable. All placing equipment shall be clean and free from hardened concrete.

B. Placing shall be continuous between transverse joints or in individual sections of the work. Spade concrete thoroughly along forms and expansion joints, and work carefully into corners and around reinforcement. Tamp and screed to a dense mass.

C. Convey concrete from mixer to place of final deposit in one continuous operation and until entire unit being placed is complete. Maintain plasticity of concrete to flow readily into formwork and embed reinforcement without segregation of aggregates.

D. Use chutes of uniform shape and slope controlling concrete fall to not more than 3'.

E. Place no partially hardened, contaminated or retampered concrete.

3.9 FINISHES: (Ref. 03 35 10.2, 03 35 10.1, 03 35 19, for finishes not shown)

A. Medium broom Finish: Shall be obtained by drawing a medium bristled broom across a floated finish. Direction of brooming to be perpendicular to direction of walk or as otherwise shown on drawings.

3.10 JOINTS: (Reference Drawings for Locations of each type joint.)

A. Score Joints: Score joints shall be formed in the fresh concrete using a jointer to cut the groove so that a smooth uniform impression is obtained. All joints shall be struck before and after brooming/troweling. Contractor to fabricate special score joint tools as shown on plans.

B. Expansion Joints and Edging: Expansion joints shall be formed provided at the location and intervals as shown on the plans, and at all locations where concrete paving abuts buildings, curbs, or other structures. Approved joint material shall be placed with top edge 1/2" below the paved surface, and shall be securely held in place to prevent movement. Joint and other edges shall be formed in the fresh concrete using an edging tool to provide a smooth uniform impression. All edges shall be struck before and after brooming. After the curing period, expansion joints shall be carefully cleaned and filled with approved joint compound to 1/4" below paved surface in such a manner as to avoid spilling on paved surfaces or overflow from joint.

C. Saw Cut Joints: Sawing of joints shall be sawn as soon as the concrete will support the weight of the saw and the operator without marking or damaging the concrete. The saw cut shall be ¼” wide by ¼ the depth of the slab and shall have chamfered edges as detailed by using the Soff-Cut Ultra Early Entry system with ProEdge beveled blades or approved equal.

3.11 CURING AND PROTECTION AND PATCHING:

A. Protect concrete against frost, rapid drying and damage by rain and keep moist for at least 7 days after placing. Protect during this period by wet burlap, canvas covering (ASTM 171) or liquid curing compound. Curing by the use of saturated burlap. Sprinkler or membrane where approved shall commence immediately upon completion of finishing. Secure Owner's approval of proposed method. During this period, maintain concrete above 70 degrees F. for at least 3 days or above 50 degrees F. for at least 5 days. Concrete from which forms are removed within 7 days after pouring shall be sprayed during the curing period as frequently as drying conditions may require. Concrete covering shall be a type that will not stain or discolor finished concrete surfaces. Cure concrete in accordance with requirements of the current ACI Manual of Concrete Practice. Apply a spray on curing compound in accordance with manufacturer's recommendation and as specified herein where allowed.

B. Protect all concrete work against injury and defacement to walls and steps during subsequent construction operations, and until acceptance by the Owner.

C. PATCHING:

1. The use of "pavecrete" or other surfacing material will not be permitted.
2. Minor chips (2" X 2") or less which occasionally occur as a result of related construction activities may be patched using approved material.
3. The color and finish of all patches must exactly duplicate the surrounding pavement.
4. Remove any stains or spills on finished concrete work immediately.
5. Upon completion of the work clean all areas.
6. Remove any chalk lines used for sawcut joint layout

END OF SECTION 32 13 14

SECTION 32 41 16 - BRICK PAVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Clay Brick Pavers
2. Bedding and Polymeric Jointing Sand
3. Edge Restraints
4. Geotextiles

1.3 REFERENCES

A. American Society for Testing and Materials
1. ASTM C 33, Standard Specification for Concrete Aggregates
2. ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.
4. ASTM C 902, Standard Specification for Pedestrian and Light Traffic Paving Brick.
5. ASTM C 1272, Standard Specification for Heavy Vehicular Paving Brick.
6. ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
7. ASTM D 1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
8. ASTM D 2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

1.4 SUBMITTALS

A. In accordance with General Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Clay Brick Pavers:
1. Submit manufacturer’s product literature, installation instructions, and material safety data sheets.
2. Submit sample units of each paver type representative of size, shape, color and finish, indicating color variation and texture range expected in finished installation. Color will be selected by Architect from manufacturer’s available color palette.
3. Submit test results from qualified independent testing laboratory indicating ASTM C 902 compliance, as applicable.
4. Submit manufacturer’s certification of conformance to ASTM standards.

C. Submit shop drawings and details: Indicate materials, thicknesses, sizes, finishes, shapes, edge restraints, perimeter conditions, expansion and control joints.
1. Indicate layout and pattern describing materials, expansion joints, geotextile location, layout and drain locations and installation details and methods.
2. Indicate relationships of paving joints to adjoining materials, fixtures and assemblies.

D. Bedding and Jointing Sand:

1. Submit sieve analysis results in accordance with ASTM C 136 for bedding sand.
2. Provide supplier name, source and type of sands used for bedding and jointing.
3. Provide color samples for jointing sand.

1.5 QUALITY ASSURANCE

A. Paving Installer Qualifications:
   1. Three years' experience with at least 100,000 square feet of sand set brick pavers installed.
   2. Successful completion of five brick paver installations similar in design, material and extent indicated on this project.

B. Mock-Ups:
   1. Install a 5 ft by 5 ft area of pavers on a prepared substrate including edge restraint to illustrate component application including pattern and edge details.
   2. When required, provide a separate mock-up for each paver type and bonding pattern.
   3. Use mock-up to determine pre-compaction bedding sand level, joint sizes, lines, laying pattern(s), and color and texture range.
   4. Do not start Work until [Architect] [Engineer] [Landscape Architect] [Owner] has approved mock-up.
   5. Approved mock-up is the standard by which appearance, workmanship, substrate preparation and material application will be judged.
   6. Document approved mock up with photographs or retain until completion of work.
   7. Approved field sample may be retained as part of finished work. Remove mock-up and dispose of materials when directed by Architect.

1.6 DELIVERY, STORAGE AND HANDLING

A. General:
   1. Deliver, store and handle in accordance with manufacturer's recommendations.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged packaging with identification labels intact.
   1. Unload pavers with proper equipment, so no damage occurs to pavers.

C. Storage: Store materials so they are protected from contamination by foreign substances and excessive moisture.
   1. Store pavers to prevent damage and staining.
   2. Do not store bedding sand and jointing sand on compacted aggregate base course or in areas that channel water into the sand.
   3. Cover bedding sand and jointing sand with waterproof covering. Secure the covering in place.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not install sand or pavers during rain or snowfall.
   2. Do not install sand or pavers over frozen base course.
   3. Do not install frozen materials.
   4. Do not install pavers on frozen or saturated sand.

1.8 MAINTENANCE

A. Extra Materials:
   1. Furnish twenty additional pavers of each size and color to Owner for future maintenance and repair.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

A. Approved Manufacturers:
   a. Pacific Clay
   b. Whitacre Greer
   c. Belden
   d. Upchurch Kimbro

B. Material Standard: In accordance with ASTM C 902, as applicable.

C. Classification: Specify weathering, traffic and application classifications.
   1. Specify Class: SX
   2. Specify Type: I
   3. Specify Application: PS

D. Dimensions: 4 x 8 x 2 ¼ & 8 x 8 x 2 ¼ as specified on drawings.

E. Color: To be selected by landscape architect from manufacturers full range of colors.

2.2 JOINTING AND BEDDING SAND

A. Approved Manufacturers:
   a. Alliance Gator Maxx Sand or approved equal.

B. Provide jointing sand and bedding sand as follows:
   1. Clean, well graded, sand free from soluble salts and other deleterious or foreign matter. Sand shall be natural silica sand or sand manufactured from crushed rock.
   2. Do not use screenings or stone dust for jointing sand or bedding sand.

B. Polymeric Joint Sand Material Requirements:
   a. Reference manufacturers specifications and installation instructions.

C. Bedding Sand Material Requirements:
   1. Comply with ASTM C 33 requirements for fine aggregate.
   2. Do not use mason’s sand, or sand conforming to ASTM C 144 for bedding sand.

2.03 EDGE RESTRAINTS

A. Furnish edge restraints.

B. Install edge restraints per manufacturer’s instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Contractor shall inspect and certify in writing to Installer that site conditions meet the following prior to bedding sand and paver installation:
   1. Remove organic, unstable or unconsolidated material from site.
   2. Verify conformance of subgrade preparation, compacted density and elevations to specified requirements.
   3. Verify geotextile placement in accordance with Project Drawings and specifications.
   4. Verify base course conformance to specified requirements. Do not use bedding sand to correct deficiencies in base course surface.
   5. Verify written density test results for soil subgrade and base course.
   6. Verify type, location and elevations of edge restraints, [concrete collars around] utility structures and drainage inlets.
   7. Verify that base course and geotextile fabric is ready to support sand, edge restraints, pavers and imposed loads.

B. Do not proceed with bedding sand or paver installation until satisfactory [subgrade soil and] base course conditions are verified by Contractor.

C. Verify that base course is dry and certified by General Contractor as meeting material, installation and grade specifications.

D. Field Measurements:
   1. Determine actual paver dimensions (including tolerances) and coordinate with dimensions for pavement areas indicated on Contract Drawings prior to any pavement installation. Adjust pavement area dimensions to eliminate unnecessary paver cutting.

3.2 PREPARATION

A. Edge Restraint Preparation:
   1. Install edge features and penetrations including curbs, planters, surrounds and bases prior to placing bedding sand layer.
   2. Install edge restraints as indicated on Project Drawings and in accordance with manufacturer’s recommendations.

B. Geotextile: Install geotextile where indicated on Contract Drawings. Lap ends and edges a minimum of 12 inches. (300 mm.)

3.3 INSTALLATION

A. Spread bedding sand evenly over base course and screed rails. Screed to 1 inch (25 mm) thickness.
   1. Do not spread bedding sand beyond area to be covered by pavers the same day.
   2. Prior to re-commencement of work remove, replace and re-screed bedding sand not covered with pavers the previous work day.
   3. Do not disturb screeded sand. Re-screed disturbed bedding sand.

B. Lay pavers in pattern(s) shown on Project Drawings.
   1. Lay full pavers first. Minimize the any sliver cuts where possible.
   2. Mix pavers from at least three cubes to produce uniform color blends.
   3. Place units by hand without using hammers.

C. Provide 1/16 inch to 3/16 inch (2 to 5 mm) wide joints between pavers.

D. Adjust pavers to form straight bond lines and appropriate joint widths. Maximum bond line variation shall be ± ½ inch (13 mm) over a 50 foot (15 m) string line.

E. Fill gaps at paved area edges with cut pavers.
   1. Cut pavers at edges as indicated on Contract Drawings with a double blade paver splitter or wet cut masonry or vacuum saw.
   2. Cut pavers shall be no smaller than one-third of a whole paver [except where pattern is to be maintained and smaller pieces are surrounded by a full paver and field paver border course]. Vehicular pavements shall have no pavers less than one-third size of the full paver.

F. Do not permit traffic, including construction equipment, on pavers before initial compaction and joint filling. Disturbed areas of pavers should be taken up, the sand re-screeded and pavers relaid.

G. Vibrate pavers into sand using a high frequency/low-amplitude plate compactor capable of 3,000 lbf to 5,000 lbf (13 to 22 kN) at a 75 to 100 Hz frequency. Protect pavers from chipping during compaction by using a plate compactor with a rubber matt, rubber rollers or other approved materials placed over pavers. Do not compact within 6 feet (2 m) of unrestrained edges. Remove cracked or damaged pavers and replace with new units.

H. After pavers are fully settled and free from movement simultaneously spread, sweep and compact dry jointing sand into joints until they are completely filled and sand no longer falls into joints.

I. Protect areas not covered with cut and compacted pavers with waterproof covering overnight.

J. Discontinue laying operations, align and compact pavers prior to work suspension when weather conditions are such that pavement performance may be compromised.

K. On laying operations recommencement, verify acceptable setting bed condition before further pavers are laid. If water has entered bedding sand, remove pavers and saturated bedding sand, install unsaturated sand replace and compact pavers.

L. Sweep excess sand from pavement when installation is complete.

N. Return to site over a period of up to one year to add sand to fill joints as needed.

O. Pavers to be engraved by Schlitzberger Monument Co. after installation.

3.4 FIELD QUALITY CONTROL

A. Finished pavement surface shall not deviate more than ± 3/8 inch (10 mm) from specified elevations.

B. Check final surface profile for conformance to Project Drawings.

C. Pavement surface elevation shall be flush with adjacent construction.

D. Maximum variation from a specified surface profile shall be ± 3/16 inch (5 mm) in 10 feet.

E. Height difference between adjacent pavers shall not exceed 1/8 inch (3 mm).

3.5 JOINT SAND STABILIZATION

A. Apply joint sand stabilization materials between brick pavers in accordance with manufacturer's written recommendations.
B. Sealers and treatments must be compatible with sealer applied during the manufacturing process. Test all products prior to use.

3.6 PROTECTION

A. After work in this Section is complete, General Contractor shall protect work from damage due to subsequent construction activity on site.

END OF SECITON 32 14 16

SECTION 32 15 40 - GRAVEL PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Decomposed granite.
2. Limestone fines
3. Stabilizer binder

B. Related Sections:
1. Section 31 22 00: Grading.

C. Reference Standards:
1. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

1.3 SUBMITTALS

A. Comply with Section 01 Shop Drawings: Submit plan layout of all decomposed granite surfacing areas and detail drawings showing the various components of the surfacing system, including subbase and edging.

B. Product Data - Manufacturer’s literature completely describing all components of the decomposed granite surfacing system, including:
1. Quarry of origin
2. Preparation instructions and recommendations.
3. Stabilizer binder brand information.
4. Installation methods and application procedures.

C. Samples for Verification - Submit samples of each of the following:
1. Two-pound sample of each type and color of decomposed granite surfacing material.
2. Edging material, each type not less than 12 inches long.

D. Certification:
1. Manufacturer and Installer Qualifications.

1.4 QUALITY ASSURANCE

A. Comply with Section 01 40 00: Quality Requirements.

B. Manufacturer: Company specializing in manufacturing Work of this Section with minimum 25 years documented experience.

C. Single Source Responsibility: Obtain each type of decomposed granite surfacing from single manufacturer.

D. Mock Up - Provide a mock-up for evaluation of surface preparation, installation techniques and quality of application:
1. Install a 4-feet x 4-feet minimum of decomposed granite surfacing, including stabilizer binder, subbase course and edging, at location approved by Landscape Architect.
2. Do not proceed with remaining work until installation of decomposed granite surfacing is approved by Landscape Architect.
3. Approved mock-up may remain as part of completed Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 60 00: Product Requirements.

B. Bagged Materials: Accept delivery of materials only in unopened and undamaged containers bearing the brand name and manufacturer's identification.

C. Bulk Materials - Each load of decomposed granite surfacing material arriving at the job site in bulk shall be accompanied by a delivery ticket containing the following minimum information:
1. Quarry of origin.
2. Amount, weight and type of material.
3. Brand name and manufacturer's identification.
4. Protect decomposed granite surface surfacing materials from contamination until ready for installation. Store under cover.

1.6 PROJECT CONDITIONS

A. Surfaces to receive decomposed granite surfacing shall be frost free and free of oil or any other foreign matter, which may impair the proper installation of the surfacing system.

B. Do not install decomposed granite surfacing when subbase course is muddy or saturated with standing water.

C. Perform work in dry weather when subgrade is sufficiently stable to be properly compacted.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

1. Manufacturer: Provide decomposed granite surfacing system and binder if used by the following:

A. The Ground-Up
1. The Ground-Up: (281) 970-003 Scott Bort (346) 314-9487 9945 Windfern Rd. Houston, TX 77064

B. Alamo Stone
1. Alamo Stone: (281) 240-4600 13020 S Kirkwood Rd, Stafford, TX. Sales@alamostone.com

C. Stabilizer® Binder
   1. Stabilizer Solutions: (800) 336-2468 33 South 28th St Phoenix, AZ
   2. Organic-Lock: (866) 636-8476Envirobond Products 6191-2100 Bloor St W. Toronto, Canada
   3. Patented, non-toxic, organic binder that is colorless and odorless concentrated powder that binds decomposed granite or crushed 3/8" or 1 /4" minus aggregate.
   4. Product to have 64% pre-consumer recycled content.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00: Substitution Procedures and Form.

2.2 DECOMPOSED GRANITE SURFACING MATERIALS

A. Recycled Content of Decomposed Granite or Crushed Stone Surfacing Materials: **10%**

B. Decomposed Granite and Crushed Stone Aggregate: Provide high quality materials consisting of sound, angular, durable stone particles, free from clay lumps, organic materials, frozen materials, or other deleterious substances.

C. Gradation - Manufacturer's standard mix of well-graded materials in accordance with ASTM C136. Blends of coarse sand and rock dust are not acceptable:

Standard Pathway Optimal Gradation		
Sieve	Sieve Size (mm)	Percent Passing
3/8"	9.51	100%
#4	4.76	80-100%
#8	2.36	65-90%
#16	1.18	40-60%
#30	0.6	25-55%
#50	0.3	15-35%
#100	0.149	10-20%
#200	0.074	7-15%

2.3 SUBBASE COURSE MATERIALS

1. 3/4" minus aggregate base class 2.

2.4 ACCESSORIES

A. Stabilizer Binder and decomposed granite shall always be blended dry. Mix uniformly and consistently throughout decomposed granite, per manufacturer's specifications.

B. Water: Clean and potable, free from contaminants that would be deleterious to the decomposed granite surfacing.

C. Steel Edging: Reference contract drawings for location, sizing, and manufacturer. Comply with Section 32 93 00.

D. Stakes: Reference contract drawings specified product and install per manufacturer specification.

E. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Application of the herbicide shall pose no short- or long-term health threats to the installer or the general public.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which Work of this Section will be performed. Notify Landscape Architect of unsatisfactory preparation before proceeding.

B. Correct conditions detrimental to timely and proper completion of Work.

C. Do not proceed until unsatisfactory conditions are corrected.

D. Lay out work prior to the commencement of installation.

3.2 PREPARATION

A. Excavation: Excavate to depth required so edges of decomposed granite surfacing will match adjacent grades and have a maximum cross-slope of 2 percent. Ensure edges and bottom of excavation are in a smooth and even line.

B. Subgrade Preparation: Plow, harrow and mix the entire surface of the in-place subgrade to a depth of at least 6-inches. After the material has been thoroughly mixed, the subgrade shall be brought to line and grade and compacted to 95% of the maximum laboratory dry density as determined by the Standard Proctor test.

C. Herbicide: Apply herbicide per manufacturer’s written instructions. Limit the application to the area to receive decomposed granite surfacing.

D. Subbase Course Preparation: Place the subbase coarse aggregate free from ridges, depressions, or hollows. Rake and compact to 95% Standard Proctor Density.

3.3 INSTALLATION

A. Steel Edging: Install edging flush with the top of the decomposed granite surfacing. Provide sufficient stakes to secure edging in place during and after decomposed granite surfacing material installation.

B. Subgrade - Proof-roll the subgrade with heavy pneumatic-tired equipment to locate unstable areas and to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades:
   1. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Landscape Architect, and replace with compacted backfill or fill as directed.
   2. The surface of the completed subgrade shall be bladed to a smooth and uniform texture.
   3. The finished subgrade shall be uniform and free from deleterious debris such as organic materials, nails, stones and loose soil.

C. Subbase: Install aggregate subbase to a compacted depth of 4 inches minimum for

pedestrian traffic, and 8 to 12-inches minimum for vehicular traffic in accordance with manufacturer's recommendations. Install the subbase in multiple 3 to 4-inch lifts, and compact to a minimum 95% density.

D. Compaction - Compact each lift of the subgrade, subbase and final finish decomposed granite surfacing materials with a one to three-ton roller or compactor. In small areas that are difficult to access with compaction equipment, hand tamping may be performed with multiple passes to achieve the required density:
   1. Lightly spray surface area following compaction. Do not disturb aggregate surface with spray action.

3.4 INSTALLATION OF DECOMPOSED GRANITE SURFACING

A. Thoroughly mix stabilizer binder and decomposed granite proportionally to manufacturer's specifications.

B. Spread decomposed granite surfacing material in 3 to 4-inch lifts. Spread the pathway mix evenly and smoothly before compacting. Allow for 20-25% compaction. Screed if possible.

C. Wet the mix to ensure water has penetrated the full depth of the decomposed granite surfacing material, and roll each lift to form a uniform, smooth surface with a cross slope of 2% maximum. Compact each lift to a minimum 95% density.

D. Grade and smooth to the required elevation; compact final lift with 1-3 ton drum roller or compactor.

E. Minimum Compacted Thickness:
   1. Pedestrian Paths: 3-inches.
   2. Vehicular Drives and Roadways: 4-inches.

F. Surface shall follow grades per plans. Remove crown, allow 1-2% cross pitch.

G. Completed surface shall be of consistent quality and shall not have depressions or humps greater than 1/4-inch in 10-feet.

3.5 INSTALLATION TOLERANCES

A. Decomposed Granite Surfacing Thickness - Allow for 20-25% compaction:
   1. Subbase Course: Plus or minus 1/2-inch.
   2. Surface Course: Plus 1/4-inch, no minus.

B. Decomposed Granite Surfacing Smoothness: Produce a surface smoothness within 1/4-inch tolerance when measured with a 10-foot straightedge.

C. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowed variance from template is 1/4-inch

3.6 CLEAN-UP AND PROTECTION

A. Thoroughly clean all areas where work has occurred. Remove from site excess material, debris and rubbish.

B. Take all precautions necessary to protect completed work until Substantial Completion of

project.

END OF SECTION 32 15 40

SECTION 32 16 13
CONCRETE CURBS AND GUTTERS AND VALLEY GUTTERS

1. SCOPE: This section of the specifications covers concrete curbs and gutters and valley gutters, complete.

2. MATERIALS AND CONSTRUCTION: All materials and construction methods shall be as specified in the specification entitled: "Excavation and Site Work," and in the specification "Concrete" with the following modifications:

2.1 Curbs and Gutters

2.1.1 General: All curbs and gutters shall be constructed of 3,500 psi concrete conforming to the specification "Concrete" and shall be of the thickness, width, and at the locations and elevations shown on the drawings.

2.1.2 Finish: Curb and gutter shall be finished true to line, grade, and cross-section, with the aid of a straight edge, steel trowel and steel "gooseneck". The straight edge is to be used on the face of the curb and in the gutter. The curb and gutter shall be worked with a steel trowel and "gooseneck" to give the work the appearance of a trowel finish, then edged and jointed.

2.1.3 Joints: Joints shall be provided where shown on the drawings, and as hereinafter specified. Edges of joints shall be rounded to a 1/8 inch radius with an edging tool.

a. Dummy Groove: Dummy groove joints shall be formed at 10 foot intervals in curbs and gutters. Dummy groove joints shall not be less than one inch in depth.

b. Expansion: Provide 3/4 inch premolded expansion joint filler in curbs and gutters at intervals not exceeding 60 feet and at edges abutting other concrete. The filler shall extend the full depth of the concrete but shall be held down 1/4 inch below the finish surface of the slab. All expansion joints shall be properly sealed with hot poured elastic bituminous sealer.

2.1.4 Reinforcing Steel: Curbs and gutters and valley gutters shall be reinforced as indicated. The reinforcing steel shall be accurately placed and adequately secured in position in the forms. It shall be maintained in place by approved concrete blocks or metal chairs or spacers. Where splicing is necessary, the bars shall be lapped at least 24 diameters, unless otherwise noted. No bar shall be spliced at points of maximum tension. The minimum thickness of protection concrete covering the reinforcing steel shall be as indicated on the drawings. If not shown on the drawings, the applicable requirements of ACI Building Code 318-63 shall govern. All reinforcing steel shall be inspected an approved by the Engineer before casting or depositing concrete.

2.1.5 It is the intention of the Engineer to show only the presence and approximate locations of existing driveways on the drawings. Their widths are variable. Whenever the presence of a driveway is indicated on the drawings or in locations designated by the Engineer, the vertical section of the curb and gutter shall be

omitted for a distance no longer than ten (10) feet. Variations from this distance must be approved by the Engineer. There will be no addition to or deduction from the unit price for curb and gutter due to the leaving out of this vertical portion of the curb. Where necessary, in the opinion of the Engineer or as shown on the plans to remove and replace a portion of an existing concrete driveway due to a conflict, either horizontal or vertical, between it and proposed new construction, that portions shall be removed along a neat, straight line formed by any method approved by the Engineer and replaced in a workmanlike manner between that line and the new construction. The new portion of driveway shall be equal in quality and appearance to that removed. The portion removed shall be disposed of by the Contractor at sites approved by the City.

2.2 Valley Gutters

2.2.1 All valley gutters shall be constructed of 3,500 psi concrete conforming to the specification entitled "Concrete" and shall be of the thickness, widths, lengths, locations, and elevations indicated on the drawings.

2.2.2 The edges of the valley gutters are to be formed on all sides in an approved manner except where they adjoin existing curbs and gutters. At these locations, premolded expansion joint material shall be placed against the edges of the existing curb and gutters and will serve at edge forms during construction.

2.2.3 Where necessary to remove existing asphalt surface and base in order to install valley gutters or elsewhere when directed by the Engineer, a jack hammer equipped with a flat blade shall be used to form a neat line where the new construction and existing pavement adjoin. There will be no separate compensation paid for removal and replacement of this asphalt surface and base and its cost will be included in the unit price for valley gutters or other pertinent items indicated in the Proposal.

2.3 Alteration or repairs of the existing valley gutters where shown shall be made as indicated in the drawings or directed by the Engineer. When completed, they shall conform as nearly as possible to the essential applicable requirements specified for new valley gutters.

END OF SECTION

SECTION 32 18 13 - SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes synthetic grass surfacing.

B. Related Requirements:

1. Section 32 91 13 Soil Preparation for preparation, compaction, and grading of granular base.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at the Edgeland Office.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For synthetic grass surfacing.

1. Include sections and details.
2. Show locations of seams and method of seaming.
3. Show layout of game lines, numbers, and letters. Indicate application method of each line and marking.
4. Show location and layout of team logo/graphics.

C. Samples: For each type of synthetic grass surfacing indicated.

1. Turf Fabric: 12 inches square.
2. Infill Material: 4 oz. of each type.
3. Shock-Attenuation Pad: 12 inches square.
4. Seam Sample: 24 inches square with seam centered in sample.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer

B. Product Test Reports: For each synthetic grass surfacing assembly.

C. 5 Year Bi-annual maintenance

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For synthetic grass surfacing, including maintenance cleaning instructions, to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents, if not covered by installation warranties.

1. Turf Fabric: Minimum of 100 sq. ft. for each type indicated.
2. Infill: Minimum of two bags of each type.

B. Installer to include bi-annual maintenance for 5 years. This maintenance will include but not be limited to:
1. Check for mold or mildew
2. Debris removal and brushing
3. Infill replenishment
4. Weed and moss prevention
5. Seam and edge repairs
6. Wear inspection
7. Deep clean

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials in location and manner to allow installation of synthetic grass surfacing without excess disturbance of granular base.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace synthetic grass surfacing that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration and excessive wear.
b. Deterioration from UV light.

c. Excessive loss of shock attenuation.
d. Seam separation, including game lines and markings.

2. Warranty Period: Limited Lifetime warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Turf Fabric: Turf fabric tested according to the following methods, with additional test method conditions for each method according to ASTM F1551.

1. Tuft Bind: Not less than 8 lbf according to ASTM D1335.
2. Breaking Strength: Minimum 200 lbf in warp direction and minimum 200 lbf perpendicular to warp direction, according to ASTM D5034.

B. Permeability: 400 in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.

2.2 SYNTHETIC GRASS SURFACING

A. Synthetic Grass Surfacing: Complete surfacing system, consisting of synthetic yarns bound to water-permeable backing and infill indicated, suitable for playgrounds.

1. SYNtipede 243 by SYNLAWN
2. Playground Grass by ForeverLawn
3. SYNTipede 321 by SYNLAWN

B. Turf Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:

1. Yarn Fiber: polyethylene
2. Pile Weight: 80 oz./sq. yd. according to ASTM D5848.
3. Pile Height: 1-½" inches according to ASTM D5823.

C. Backing: Manufacturer's standard woven or nonwoven polypropylene primary backing with urethane-coated secondary backing; provide perforations or drainage channels sufficient to meet permeability indicated.

D. Infill: Manufacturer's standard organic infill.

1. Infill Proportions: Manufacturer's standard proportions

E. Seaming Method: Adhesive

2.3 MATERIALS

A. Contractor to use infill per manufacturer's specifications.

B. Seam Adhesive: One- or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.

C. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches wide.

D. Seaming Cord: Seaming cord or thread, recommended by the synthetic grass surfacing manufacturer.

E. Shock-Attenuation Pad: Porous composite consisting of rubber granules bound with urethane adhesive, 2 inches thick; per manufacturer's recommendation to meet CPSI requirements within designated fall zones. Provide shock-attenuation pad with permeability sufficient to meet synthetic grass surfacing assembly permeability indicated. Contractor to coordinate fall zones with playground equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine base and other conditions, with Installer present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Avoid disturbance of base during installation of shock-attenuation pad and turf fabric.

B. Shock-Attenuation Pad Installation: Roll out pad and allow to relax a minimum of six hours prior to final fit and trim. Stagger head seams between adjacent rows. Fit seams snugly without stretching or forcing.

C. Roll out turf fabric and allow to relax at least four hours prior to seaming.

D. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.

E. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.

F. Evenly broadcast and groom infill by machine in proportions and depth after settling as recommended by the manufacturer, and to meet indicated performance requirements. Rake fibers trapped by infill to surface.

G. Provide ½"(in) pile height system at high traffic zones. Typical at base of swings, slides, and other play elements. Confirm layout with landscape architect.

H. Ground all play elements below surface of turf with 8' grounding rod.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Manufacturer to perform tests and inspections.

B. Perform the following tests and inspections:

1. Permeability: 400 in./h per SY of rainfall capacity according to ASTM F2898 or EN 15330-1.
2. Shock Attenuation: Meeting minimum requirements at time of installation according to ASTM F1936.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION 32 18 13

SECTION 32 1816.13 – PLAYGROUND PROTECTIVE SURFACING.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Poured-in-Place Playground Surfacing System: Super-7 (when aromatic urethane for the top surface is specified) with a 7-year warranty & Extreme-10 (when aliphatic urethane for the top surface is specified) with a 10-year warranty.

B. Related Requirements:
1. Sections: Materials and Methods, Excavation, Asphalt Paving, Concrete Paving, Sub-Drainage, Storm Drainage, Fencing, Playground Equipment and Structures.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. 1. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elas-tomers-Tension.
2. 2. ASTM D624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
3. 3. ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Meas-ured by the James Machine.
4. 4. ASTM D2859 Standard Test Method for Flammability of Finished Textile Floor Covering Materials.
5. 5. ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Test-er.
6. 6. ASTM F1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
7. 7. ASTM F1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide a 2-layer rubber-urethane playground surfacing system which has been designed, manufactured and installed to meet the following criteria:
1. Shock Attenuation (ASTM F1292):
   a. Gmax: Less than 200.
   b. Head Injury Criteria: Less than 1000.
2. Flammability (ASTM D2859): Pass.
3. Tensile Strength (ASTM D412): 60 psi (413 kPa).
4. Tear Resistance (ASTM D624): 140%.
5. Water Permeability: 0.4 gal/yd2/second.
6. Accessibility: Comply with requirements of ASTM F1951.

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Proce-dures Section.

B. Product Data: Submit manufacturer's product data and installation instructions.

C. Verification Samples: Submit manufacturer's standard verification samples of 9" x 9" (229 x 229 mm) minimum.

D. Quality Assurance/Control Submittals: Submit the following:
1. Certificate of qualifications of the playground surfacing installer.

E. Closeout Submittals: Submit the following:
1. Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Qualifications: Utilize an installer approved and trained by the manufacturer of the playground surfacing system, having experience with other projects of the scope and scale of the work described in this section.

B. Certifications: Certification by manufacturer that installer is an approved applicator of the playground surfacing system.

C. International Play Equipment Manufacturers Association (IPEMA) certified.

1.7 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification la-bels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 40 degrees F (4 degrees C) and a maximum temperature of 90 degrees F (32 degrees C).

D. Specifier Note: In article below, state physical or environmental limitations or criteria for installation such as weath-er, temperature, humidity, ventilation or illumination required for proper installation or application.

1.8 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Install surfacing system when minimum ambient temperature is 40 degrees F (1 degree C) and maximum ambient temperature is 90 degrees F (32 degrees C). Do not install in steady or heavy rain.

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

C. Proper drainage is critical to the longevity of the PlayBound Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty.
   1. 1. Warranty Period: Extreme-10 (when aliphatic urethane for the top surface is specified): 10 years from date of com-pletion of work. DD

PART 2 - PRODUCTS

2.1 POURED-IN-PLACE PLAYGROUND SURFACING SYSTEM

A. Manufacturer: Surface America, Inc.
   1. Contact: PO Box 157, Williamsville, NY 14231; Telephone: (800) 999-0555, (716) 632-8413; Fax: (716) 632-8324; E-mail: info@surfaceamerica.com; website: http://www.surfaceamerica.com.
      a. Proprietary Products/Systems. Poured-in-place playground surfacing system, including the following:
         1) PlayBound Poured-In-Place Primer:
            a) Material: Urethane.
         2) PlayBound Poured-in-Place Basemat:
            a) Material: Blend of 100% recycled SBR (styrene butadiene rubber) and urethane.
            b) Thickness, Reference Critical Fall Height Plans: 1 1/4" for 4' critical fall height, 2" for 5' critical fall height, 2 1/2" for 6' and 7' critical fall heights, 3" for 8' critical fall height, 3 1/2" for 9' critical fall height, 4" for 10' critical fall height, 5" for 12' critical fall height, 6" for 13' critical fall height.
            c) Formulation Components: Blend of strand and granular material.
         3) PlayBound Poured-In-Place Top Surface:
            a) Material: Blend of recycled EPDM (ethylene propylene diene monomer) rubber and aromatic or aliphatic ure-thane binder.
            b) Thickness: Nominal 1/2" (12.7 mm), minimum 3/8" (9.5 mm), maximum 5/8" (15.9 mm).
            c) Color: Reference Plans for custom color blends.
            d) Dry Static Coefficient of Friction (ASTM D2047): 1.0.
            e) Wet Static Coefficient of Friction (ASTM D2047): 0.9.
            f) Dry Skid Resistance (ASTM E303): 89.
            g) Wet Skid Resistance (ASTM E303): 57.

2.2 PRODUCT SUBSTITUTIONS

A. Substitutions shall meet or exceed product warranty and provide equal matches to color spectrum as noted on plans. Substitutions must meet or exceed critical fall height requirements and basemat thicknesses shall be adjusted per the new manufactures requirements.

2.3 MIXES

A. Required mix proportions by weight:
   1. Basemat: 16+% urethane (as ratio: 14% urethane divided by 86% rubber). 14% urethane, 86% rubber (based on entire rubber & urethane mix).
   2. Top Surface: 22% urethane (ratio: 18% urethane divided by 82% rubber). 18% urethane, 82% rubber (based on entire rubber & urethane mix).

2.4 SUBBASE

A. Concrete Subbase
1. Reference Specification: 32 1314
a. Concrete Strength: 4000 PSI
b. Finish: Medium Broom

B. Crushed Stone
1. Quarry process, crushed limestone,
a. ¾ inch, angular, no fines to allow for drainage

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the playground surfacing manufacturer.
1. Landscape Architect to be present at time of installation.

3.2 SUBBASE PREPARATION

A. Concrete
1. Contractor to install concrete base in accordance with Specification 32 1314.

B. Crushed Stone
1. Grade subgrade to plan, compact to 95% proctor.
2. Install geotechnical filter fabric and drainage gravel. Compact drainage gravel to 95% proctor, 4 inch lifts – max.
3. Place crushed stone in 4 inch lifts, compact to 95% proctor.
a. Do not exceed 10 inches of base.
b. Compact stone to a smooth and continuous shape per plans.

3.3 EXAMINATION

A. Substrate preparation must be in accordance with surfacing manufacturer's specification. New asphalt must be fully cured – up to 30 days. New concrete must be fully cured – up to 7 days.

B. Landscape Architect to review and confirm grades are per plan. Once approved the drainage test may take place, see below.

C. Proper drainage is critical to the longevity of the PlayBound Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty.
1. Contractor to verify drainage system is functioning as intended and provide photographic and video proof. Landscape Architect to be present during testing. Testing to include the use of a sprinkler system to flood the area with an equal amount of water equivalent to 2 inches of rain per hour for a time period of one hour. Photographs shall be taken prior, during, immediately after, and 2 hours after the drainage test. Photos shall document the drainage system properly managing the water. If system if found to be improperly installed or modifications shall occur to mitigate the issues and an additional test shall take place until all issues are remedied.

3.4 PREPARATION

A. Surface Preparation: Using a brush or short nap roller, apply primer to the substrate perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).

B. Specifier Note: Coordinate article below with manufacturer's recommended installation requirements.

3.5 INSTALLATION

A. Do not proceed with playground surfacing installation until all applicable site work, including substrate preparation, fencing, playground equipment installation and other relevant work, has been completed.

B. Basemat Installation:
1. Using screeds and hand trowels, install the basemat at a consistent density of 29 pounds, 1 ounce per cubic foot (466 kg/m3) to the specified thickness.
2. Allow basemat to cure for sufficient time so that indentations are not left in the basemat from applicator foot traf-fic or equipment.
3. Do not allow foot traffic or use of the basemat surface until it is sufficiently cured.

C. Primer Application: Using a brush or short nap roller, apply primer to the basemat perimeter and any adjacent vertical barriers such as playground equipment support legs, curbs or slabs that will contact the surfacing system at the rate of 300 ft2/gal (7.5 m2/L).

D. Top Surface Installation:
1. Using a hand trowel, install top surface at a consistent density of 58 pounds, 9 ounces per cubic foot (938 kg/m3) to a nominal thickness of 1/2" (12.7 mm).
2. Allow top surface to cure for a minimum of 48 hours.
3. At the end of the minimum curing period, verify that the top surface is sufficiently dry and firm to allow foot traffic and use without damage to the surface.
4. Do not allow foot traffic or use of the surface until it is sufficiently cured.
5. Specifier Note: Specify provisions for protecting work after installation but prior to acceptance by the owner. Coordinate article below with Division 1 Execution Requirements Section.

3.6 PROTECTION

A. Protect the installed playground surface from damage resulting from subsequent construction activity on the site.

END OF SECITON 32 18 16.13

SECTION 32 31 11- GATE OPERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's schedules, charts, literature, and illustrations indicating the performance, fabrication procedures, product variations and accessories indicating material compliance and specified options.
   2. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MOTOR OPERATION FOR GATES

A. Electric Sliding Cantilever Gate Operation:
   1. Basis of Design: SlideSmart DC 15 as manufactured by HySecuirty.
   2. Features:
      a. Duty Cycle: Continuous.
      b. Drive: Electromechanical.
      c. Gate Length Max: 40 Ft.
      d. Gate Weight Max: 1500 lb.
      e. Pull Force: 300 lb.
      f. Operating Voltage: 24 VDC.
      g. Communication: USB, RS-232, RS-485.
      h. Input Voltage: 208-230V 50/60 Hz
      i. Finish: Zinc plated chassis; molded polyethylene cover.
      j. ETL Listed (UL 325): Usage Class I, II, III, IV.

2.2 ACCESS CONTROL EQUIPMENT

A. Card reader systems
   1. Programmable stand-alone.
   2. Computer programmed (Windows software available).
   3. Proximity type (No-Touch).

B. Intercom for voice communication.

C. Hard wired control stations of all types lockout switches and best-cored key switches available.

D. Hold open key switches.

E. Hardwired detection devices for "free exit"
   1. Loop detectors.

F. Radio Frequency Devices
   1. Receivers.
   2. Transmitters.
   3. Keypads.

4. Multiple channels.
5. Programmable In or Out of system.
6. Long Range.
7. Key chain type.
8. Passive Identification Devices.

G. Emergency Vehicle Access (Fire, Police, etc.)
1. Strobe detector.
2. Siren Operated.
3. Police band RF operated.

H. Digital lighted keypads
1. Stand-alone.
2. Computer programmed.
3. Multiple security levels.
4. With Intercom.
5. Wireless.

2.3 GATE SAFETY

A. Gate edges to reverse or stop the gate.

B. Magnetic vehicle detectors.

C. Yellow strobe lights.

D. Audible warning.

E. Signage warning signs custom language types available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries of work are clearly established.

3.2 INSTALLATION

A. Install in a workmanlike manner in conformance with manufacturer’s printed instructions and details.
Anchor or install electric operator on a concrete foundation. Using 1/2x41/2 Hilti Quick bolt concrete stud type anchors.

B. Have at least 2 years previous experience in gate operator installations.

C. Installer must provide service after the sale and be able respond in a reasonable time should trouble occur.

D. Installer must provide references from job of a like nature.

E. Must provide drawings showing layout and typical locations for all equipment that is being supplied.

F. License electrician must perform all electrical connections.

G. Supply electrical power to operator through its own dedicated circuit breaker.

3.3 CLEANING

A. Clean up debris and unused material, and remove from the site.

B. Operators are intended for use in controlling vehicular traffic and are not intended to be used by pedestrians or to control pedestrian traffic. Always install a separate pedestrian man gate.

END OF SECTION 32 31 11

SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Decorative aluminum fences.
   2. Gates.

B. Related Requirements:
   1. Section 03 30 00 - Cast-in-Place Concrete.
   2. Section 31 23 16 - Excavation.

1.3 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

1.5 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings:
   1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

D. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation anchor bolt templates,..

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines.

H. Field Inspection Records: Provide installation inspection records that include post settings, framework, fittings and accessories, gates, and workmanship.

I. Manufacturer's Warranty.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
   1. Refer to Section 01 60 00 - Product Requirements for additional provisions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.8 WARRANTY

A. Refer to Section 01 77 00 - Closeout Procedures for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Specifications are based on the products identified as Basis of Design. Manufacturers listed whose products meet or exceed the specifications are approved for use in the Work. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.
   1. Decorative Aluminum Fences and Gates:
      a. Alumi-Guard: www.alumi-guard.com/#sle.
      b. Ameristar Perimeter Security, USA: www.ameristarfence.com/#sle.
      c. Ideal Aluminum Products: www.ideal-ap.com/#sle.
      d. Knotwood, a brand of OmniMax International: www.knotwood.com/#sle.
      e. Superior Aluminum Products, Inc: www.superioraluminum.com/#sle.
      f. Ultra Aluminum Manufacturing Inc: www.ultrafence.com/#sle.
   2. Specialty Hardware:
      a. DAC Industries, Inc; Detex Exit Bar: www.dacindustries.com/#sle.

B. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.2 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils (0.058 mm), minimum.

C. Aluminum: ASTM B221.
   1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
   2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
   3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.

D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

2.3 ALUMINUM FENCE

A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.
   1. Fence Panels: 8 feet (1.8 m) high by 6 feet (1.8 m) long.
      a. Posts: Aluminum extrusions; 2-1/2 inches (63 mm) square.
      b. Rails: Extruded aluminum channels.
      c. Pickets: Extruded aluminum tubes.
         1) Style: Pickets with finial extend above top rail.
      d. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.

e. Accessories: Aluminum castings, extrusions, and cold-formed strips; factory finished to match fence.
f. Color: To be selected by Architect from manufacturer's standard range.
g. Basis of Design:
1) Ameristar Perimeter Security, USA; Aegis Plus Majestic: www.ameristarfence.com/#sle.

B. Decorative Aluminum Post-and-Rail Fence and Swinging Gates:
1. Posts: Aluminum extrusions; 4 inches (101 mm) square.
2. 3/16 inch minimum
3. Color: Black.
4. Products:
a. Alumi-Guard, Post and Rail Fences; Chariot 2 - Rail: www.alumi-guard.com/#sle.

C. Decorative Aluminum Cantilever Gates:
1. Gate Panels: Manufacturer's standard decorative aluminum fence panels.
2. Description: 9 inch square tube frame.
3. Height and Length: Refer to Door Schedule.
4. Hardware:
a. Latch: Manufacturer's standard mechanism; factory finished galvanized steel.
b. Truck Assembly: Manufacturer's standard, self-aligning, wheeled truck assembly supporting weight of gate plus 2,000 pound (910 kg) reaction load; provide number of truck assemblies per gate recommended by manufacturer.
c. Guide Wheel Assembly: Manufacturer's standard, adjustable, dual wheel assembly; provide number of guide wheels per gate recommended by manufacturer.
5. Operation: Manual.
6. Color: Manufacturer's standard, factory applied-Black.

2.4 SPECIALITY HARDWARE

A. Rollers: Finished to match fence components.
1. Load Rating: 500 pounds (227 kg).
2. Groove: Flat.
3. Material: Steel.
4. Bearings: Ball.
5. Mounting: Center.
6. Brackets: Round.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. When cutting rails immediately seal the exposed surfaces by:
1. Removing metal shavings from cut area.
2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
3. Apply two coats of custom finish spray paint matching fence color.
4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.

D. Excavate post holes in accordance with Section 31 23 16.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6.3 mm).

B. Maximum Offset From Indicated Position: 1 inch (25.4 mm).

C. Minimum Distance from Property Line: 6 inches (152 mm).

3.5 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 - Quality Requirements for additional requirements.

B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.

C. Post Settings: Randomly inspect three locations against design for:
   1. Hole diameter.
   2. Hole depth.
   3. Hole spacing.

D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.

E. Workmanship: Verify neat installation free of defects.

3.6 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

3.7 CLOSEOUT ACTIVITIES

A. Refer to Section 01 77 00 - Closeout Procedures for closeout submittals.

B. Refer to Section 01 79 00 - Demonstration and Training for additional requirements.

3.8 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION 32 31 19

SECTION 32 33 13 - SITE BICYCLE RACKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior bicycle racks.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Mounting surface for bicycle racks.

B. Section 05 50 00 - Metal Fabrications: Custom metal outdoor furnishings.

C. Section 32 13 13 - Concrete Paving: Mounting surface for bicycle racks.

D. Section 32 33 14 - Site Bicycle Lockers.

E. Section 32 33 15 - Site Bicycle Shelters.

1.3 PRICE AND PAYMENT PROCEDURES

A. See Section 01 23 00 - Alternates for product alternatives affecting this section.

B. This section describes a base bid product; refer to Section _____ for an alternative product.

C. This section describes an alternative product; refer to Section _____ for the base bid product.

1.4 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).

D. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes; 2021.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

I. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

J. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

K. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.

L. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle racks with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Exterior Bicycle Racks:
1. American Bicycle Security Company: www.ameribike.com/#sle.
2. BRP by Bison, Inc: www.brpbybison.com/#sle.
3. Columbia Cascade Company: www.timberform.com/#sle.
4. Highland Products Group, LLC: www.indoorbikeracks.net/#sle.
5. Huntco Supply, LLC: www.huntco.com/#sle.
6. MADRAX, a brand of Graber Manufacturing, Inc: www.madrax.com/#sle.
7. Neenah Foundry, a division of Neenah Enterprises, Inc: www.nfco.com/#sle.
8. Reliance Foundry Co. Ltd: www.reliance-foundry.com/#sle.
9. Saris Infrastructure: www.sarisinfrastructure.com/#sle.
10. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 BICYCLE RACKS

A. Exterior Bicycle Racks: Device allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
1. Style: Serpentine rack formed from a continuous round pipe.
2. Capacity: Nine bicycles.
3. Mounting, Ground: In-ground anchor.
4. Finish: Powder coat, maintenance-free and weather-resistant.
5. Color: As selected by Architect from manufacturer's standard range.
6. Accessories: Surface flange cover.

B. Materials:
1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.
2. Pipe: Stainless steel, ASTM A312/A312M, Type 304, Schedule 40S.
3. Tube: Carbon steel, ASTM A500/A500M.
4. Tube: Stainless steel, ASTM A269/A269M, Grade TP304, seamless.
5. Bar, Round and Flat, Carbon Steel: ASTM A36/A36M.
6. Bar Round and Flat, Stainless Steel: ASTM A666, Type 304.
7. Molded or Extruded Plastic: 100 percent, high-density, UV stabilized polyethylene.
8. Precast Concrete:
    a. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.
    b. Concrete Materials: ASTM C33/C33M aggregate, water, and sand.
    c. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size required by precast unit design.
    d. Concrete Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent.
    e. Air Entrainment Admixture: ASTM C260/C260M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive bicycle racks.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

C. Do not begin installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure surfaces to receive bicycle racks are clean, flat, and level.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install level, plumb, square, and correctly located as indicated on drawings.

C. In-Ground Anchor Installation:
   1. Prepare holes in size according to manufacturer’s instructions.
   2. Place anchoring bolts through the holes in pipe.
   3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch (38 mm) from the ground.
   4. Place concrete.
   5. Level rack before concrete sets.
   6. Support until dry.

D. Post-Installed Anchors: Comply with ICC-ES AC308.

E. Surface Flange Installation: Anchor bicycle racks securely in place with 1/2 inch (13 mm) by 4 inch (101 mm) anchor bolts through flange holes.

F. Freestanding Installation: Place in location indicated on drawings.

3.4 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 32 33 13

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SECTION 32 91 00 - SOIL PREPARATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Furnish components of the planting mediums.
2. Testing and/or certifications of components
3. Mixing of planting mediums.
4. Transporting mediums as required.
5. Weed Control

B. Related Sections:
1. Finish Grading - Section 31 22 15
2. Sprinkler Irrigation System - Section 32 84 00
3. Lawns and Grasses - Section 32 92 00
4. Planting - Section 32 93 00

1.2 QUALITY ASSURANCE

A. Certificates of Inspection: Certificates of inspection required for transportation shall accompany invoice for each shipment of materials. File copies of certificates with Landscape Architect after acceptance of material.

B. Testing:
1. Chemical and Physical - All soil components shall be tested by one of the following testing laboratories for conformity to the specifications:

   Texas Plant and Soil Lab
   5115 West Monte Cristo
   Edinburg, Texas 78539
   (956) 383-0739

   A&L Plains Agricultural Laboratories, Inc.
   302 34th Street
   Lubbock, Texas 79404
   (806) 763-4278

   Soil and Plant Laboratory, Incorporated
   Post Office Box 153
   Santa Clara, California 95052
   (408) 243-0330

2. Biological:
   Soil Food Web, Inc.
   1128 NE 2nd Street Suite 120
   Corvallis, Oregon 97330
   www.soilfoodweb.com
   (541) 752-5066

3. If herbicide contamination is suspected, then a radish/rye-grass growth trial must be performed.

4. For delivered material, test one grab sample for each fifty (100) cubic yards of bulk material delivered to the site.

5. Testing will be at the expense of Contractor.

6. Deviations greater than plus or minus twenty (20%) percent from control data may be grounds for rejection of mixes tested. Non-conforming materials shall not be used. Materials which do not conform to standards specified herein shall be removed from the site.

1.3 SUBMITTALS:

A. Furnish copies of manufacturers literature, certifications, sources, samples**,** or laboratory analytical data for the following items:
1. Existing soil testing data
2. Organic Amendments and Fertilizers
3. Planting Soil
4. Topsoil.
5. Sand.
6. Native Mulch (composted).
7. Compost.
8. Herbicides
9. Pre-Emergent Herbicides

PART 2 PRODUCTS

2. 1 PLANTING SOIL:

A. Grading:

Sieve Size	Percent Passing Sieve
25.4 mm (1")	95-100
9.51 mm (3/8")	85-100
53 Micron (270 mesh)	10- 30

B. Chemistry - Suitability Considerations:
1. Salinity: Saturation Extract Conductivity (ECe x 103 @ 25 degrees C.) less than 2.2 mmhos/cm.
2. Sodium: Sodium Absorption Ratio (SAR) less than 9.0.
3. Boron: Saturation Extract Concentration less than 2.0 ppm.
4. Reaction: pH of Saturated Paste: 6 - 7.5.

C. Pests:
The population of any single species of plant pathogenic nematode: Fewer than 500 per pint of soil (confirm by biological testing).

D. Fertility Considerations:
Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium, and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials to overcome inadequacies prior to planting.

E. Source of above shall be approved and conformity of material shall be laboratory verified for each 100 cubic yards of material delivered to the site.

F. Percentage of Organic Matter: Min. 4-8%

G. Physical Soil Parameters
1. Clay: 5-25%
2. Silt: 25-50%
3. Sand: 25-50%

2.2 ON SITE MATERIAL:

A. Specified backfill mixes shall consist of on site material generally conforming to the requirements in this specification.

B. Test on site topsoil from designated stockpile area or borrow site for conformity to this specification. Submit test to Landscape Architect for verification and alteration of components.

2.3 WOOD RESIDUALS:

A. Source:
Shall be non-composted and/or stockpiled, and not have been chemically treated or dyed.

B. Physical Properties - Grading:

U.S. Sieve Dry Weight Percent Passing

3/8"	100
1/4"	90 - 100
No. 8	70 - 100
No. 35	0 - 30

C. Organic Content by Ash Analysis:

90 - 100 Percent Dry Weight

D. Chemistry Range:

1. Saturation Extract Conductivity (ECc) Nil - 3.5

2. Reaction (pH) 6-8

E. Salinity: Maximum saturation extract conductivity 3.5 millimhos per cm @ 25 degrees centigrade.

2.4 SAND:

A. Physical Properties - Grading:

U.S. Sieve Percent Passing

No. 4 100

No. 10	95 - 100
No. 18	90 - 100
No. 35	65 - 100
No. 60	0 - 50
No. 140	0 - 20
No. 270	0 - 7

B. Chemistry: Range:
1. Saturation Extract Conductivity (ECc) Nil - 3.0
2. Sodium Absorption Ratio (SAR) Nil - 6.0
3. Boron - ppm in saturation extract solution Nil - 3.0
4. Reaction (pH) 6.0 - 7.5
5. Available calcium - sodium acetate extractable - ppm dry weight Nil – 4000
6. Soluble-Salt Content: 1 to 2dS/m measured by electrical conductivity
7.

C. Coarse Sand – concrete sand

2.5 COMPOST:

Made from recycled natural materials screened to 1” minus (for soil additive). On the Solvita compost maturity test score, must score a value of 5 or higher for tilling into the soil and be a minimum of 6 months old and fully composted. Supplied by Nature’s Way Resources, Inc., Conroe, Texas or approved equal.

A. Chemical components:
1. pH - 6.0-8.0
2. Nitrogen – 30 ppm or higher
3. Phosphorus – 150 ppm or higher
4. Potassium – 400 ppm or higher
5. Calcium – 3000 ppm or higher
6. Magnesium – 250 ppm or higher
7. Salinity – 2500 ppm or lower
8. Zinc – 6 ppm or higher
9. Iron – 25 ppm o higher
10. Manganese – 16 ppm or higher
11. Copper – 0.4-2.0 ppm
12. Sodium – 1000 ppm or less
13. Sulfur – 25 ppm or higher
14. Boron – 2 ppm or higher

B. Biological components:
1. Bacteria – minimum of 150 micrograms per gram of soil of total bacteria
2. Fungus – minimum of 150 micrograms per gram of soil of total fungus
3. Protozoa
   a. flagellates – 10,000 units per gram of soil
   b. amoebae – 10,000 units per gram of soil
   c. ciliates – 20 units per gram of soil

2.6 CHEMICAL ADDITIVES (OR EQUIVELANTS):

The following soil components listed may have a particular application specified within this Section. Some of the soil components included shall be applied at rates determined by the soil tests called for under other paragraphs of this Section or as a result of soil tests. Some

of the components may not be required by the soils tests. All additives shall be the slow release type.

A. Ground Limestone: Agricultural limestone containing not less than eighty five (85%) percent of total carbonates, ground to such fineness that fifty (50%) percent will pass a 100 mesh sieve and ninety (90%) percent will pass a 20 mesh sieve.

B. Dolomite Lime: Agricultural grade mineral soil conditioner containing thirty five (35%) percent minimum magnesium carbonate and forty nine (49%) percent minimum calcium carbonate, 100 percent passing #65 sieve. Kaiser Dolomite 65 AG or approved equal.

C. Gypsum: Agricultural grade product containing eighty (80%) percent minimum calcium sulphate.

D. Iron Sulphate (Ferric or Ferrous): Shall contain thirty (30%) to thirty five (35%) percent iron, thirty five (35%) to forty (40%) percent sulphur and be supplied by a commercial fertilizer supplier.

E. Sulphate of Potash: Agricultural grade containing fifty (50%) percent to fifty three (53%) percent of water soluble potash.

F. Single Superphosphate: Commercial product containing nineteen (19%) to twenty (20%) percent available phosphoric acid.

G. Ammonium Sulphate: Commercial product containing approximately twenty one (21%) percent ammonia.

H. Calcium Nitrate: Agricultural grade containing fifteen and one-half (15 1/2%) percent Nitrogen.

I. I.B.D.U. (Iso Butyldiene Diurea): Commercial product containing thirty one (31%) percent Nitrogen.

J. Soil Sulphur: Agricultural grade sulphur containing a minimum of ninety six (96%) percent sulphur.

K. Iron Chelate Micronutrient: Sequestrene - 330 Fe; 0-0-0; ten (10%) percent Fe; Ciba-Geigy Company.

2.7 FERTILIZERS AND NUTRIENT AMENDMENTS: all 100% organic

A. Fertilizer: MicroLife organic fertilizer as supplied by San Jacinto Environmental Supplies, Houston, Texas or approved equal.

B. Minor and Trace Elements: Humates Plus 0-0-4 as supplied by San Jacinto Environmental Supplies, Houston, Texas or Green Sand as supplied by Nature's Way Resources, Inc. or approved equals.

PART 3 EXECUTION

PLANTING

3.1 LAWN AND NATIVE SEED AREAS – Hydromulch and Sod

A. After finish grade approval and before laying sod or spreading seed apply:

1. 2” layer of compost uniformly across area
2. 20# of MicroLife 6-2-4 fertilizer per 1,000 sq. ft.
3. 10# of MicroLife humates plus 0-0-4 trace elements per 1,000 sq. ft.
4. After laying sod or spreading seed, foliar spray the entire area with 8ox of MicroLife Super Seaweed mixed with a gal of water. Each gallon of mix to cover 1,000 sq. ft.

B. Disk or till into the soil to a depth of 2”-4” until the amendments are fully incorporated before seeding and/or planting (See Section 32 92 00).

3.2 SHADED GROUNDCOVER AREAS

A. After finish grade approval apply:
1. 1” layer of Compost uniformly across area
2. 3” (in) Planting Soil
3. 40# of MicroLife ultimate 8-4-6 fertilizer per 1,000 sq. ft.
4. 10# of MicroLife humates plus 0-0-4 trace elements per 1,000 sq. ft.

B. Disk or till into the soil to a depth of 4” until the amendments are fully incorporated before groundcover planting (See Section 32 92 00).

3.3 TREE PLANTING AREAS (Within Tree Excavation Pit)

A. After finish grade approval before mulching apply:
1. Backfill with a 50/50 blend of existing topsoil and Planting Soil
2. For every 15 gal. tree size, add 6 oz. MicroLife Ultimate 8-4-6
3. 3 oz of JRM Mycorrhizal Tree Transplant
4. 2 oz of MicroLife Super Seaweed mixed with a gal. of water. Use 2 gal. of mixed solution per 15-gal. tree size

3.4 SUNNY GROUNDCOVER AND PERENNIAL AREAS

A. After finish grade approval apply:
1. 4”(in) Planting Soil
2. 40# of MicroLife ultimate 8-4-6 fertilizer per 1,000 sq. ft.
3. 10# of MicroGro Granular per 1,000 sq. ft.
4. 2 oz of MicroLife Maximum Bloom 3-8-3 mixed with a gal. of water as a new plant/root stimulator. Water soak the area sufficiently to get uniform saturation.

B. Disk or till into the soil to a depth of 6” until the amendments are fully incorporated before planting (See Section 32 93 00).

3.5 SHRUB PLANTING

A. After finish grade approval before mulching apply:
1. 4”(in) Planting Soil
2. 40# of MicroLife ultimate 8-4-6 fertilizer per 1,000 sq. ft.

B. Disk or till into the soil to a depth of 6” until the amendments are fully incorporated before planting (See Section 32 93 00).

3.6 EXISTING TREES (12”+ cal.)

A. Once a year treatment

1. 2 gal. of MicroLife Bio-Matrix 7-1-3
2. 6 oz of JRM Mycorrhizal Injectables per 100 gal. of water

WEED CONTROL/TREATMENT

A. All site locations to receive planting where weeds exist, shall be treated with post-emergent herbicide.
   1. Repeat treatment as required to ensure that no weeds are present at the beginning of work on the landscape planting of the Project.

B. Weeds shall not be present at the date of inspection for Substantial Completion of the Project and at the conclusion of the maintenance and establishment period following acceptance of the Contractor's work.

C. Post-emergent weed treatment includes:
   1. Removal of weeds and other undesirable ground cover vegetation in turf/grass and planting areas shall be accomplished a minimum of 14 days prior to soil preparation for planting operations.
   2. Care shall be taken not to affect existing trees, shrubs, and plants on and near the site.

D. Pre-Emergent Herbicide treatment:
   1. Apply per manufacturers distribution rate prior to mulching and directly after mulching.
   2. Snapshot, Princep or Specticle are approved Pre-Emergents. Contractor to submit product for approval.

END OF SECTION 32 91 00

SECTION 32 92 00 - LAWNS AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Hydromulch Seeding and Soil Supplements
2. Dry Application Seeding.
3. Solid Sod Installation

B. Related Sections
1. Finish Grading - Section 31 2215
2. Planting - Section 32 9300
3. Landscape Maintenance - Section 32 9400

1.2 QUALITY ASSURANCE

A. Source:
1. Seed: The Owner's representative shall be furnished a signed copy of statement from vendor, certifying that each container of seed delivered is labeled in accordance with the Federal Seed Act and is at least equal to requirements previously specified. Seed analysis shall be furnished prior to commencement of planting operations. Each lot of seed may be resampled and retested in accordance with latest Rules and Regulations under the Federal Seed Act at the discretion of the Owner's representative. If these tests reveal the seed to be below the specified pure live seed content, the Contractor shall be required to plant additional seed to compensate for the deficiency at no additional cost to the Owner. The State Seed Laboratory will conduct the seed retests. Allowance will be made for the actual pure live seed content of the specified grasses in determining the actual planting rate.

B. Inspections:
1. Make written request for inspection after seeding operations have been completed. Such inspection is for the purpose of establishing the Maintenance Period.
2. Submit written requests for inspections to the Owner's representative at least 7 days prior to anticipated inspection date.

1.3 SUBMITTALS

A. Furnish required copies of manufacturers literature, certifications, or laboratory analytical data for the following items:
1. Seed source. (Certification)
2. Fiber mulch. (Laboratory analytical data)
3. Tank mix fertilizer. (Certification or laboratory analytical data)
4. Topdress fertilizer. (Certification)

1.4 MAINTENANCE BY THE CONTRACTOR (refer to section 32 94 00)

1.5 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Owner's representative upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn or prairie establishment shall be as follows:

1. For Sod: Complete lush cover with no brown sections or cracks showing. Sod shall have established to the extent that satisfactory capillary action between the sod and soil has been established.
2. For Lawn Seed: 95% uniform coverage of grass in excess of 1" height. No bare spots of greater than 2 square feet will be accepted.
3. For Native Seed: 90% coverage of plants in excess of 6" height. No bare spots greater than 2 square feet will be accepted.
4. The Owner's representative and/or Owner shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.
5. If the seeding season for Native Grass Mix is missed due to the wrong season for proper germination and grow-in, the contractor is required to return to the project site and apply seed the following appropriate season at no additional cost to the owner. **Native seed shall be installed March-June.**

PART 2 - PRODUCTS

2.1 SEED

A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act. All seed shall be furnished in sealed standard containers unless exception is granted in writing by the Owner's representative. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

B. The minimum percentage by weight of pure live seed in each lot of seed shall be as follows and seed shall be planted at the rate per acre indicated under pure live seed required per acre.

Kind of Seed	Minimum % Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
MEADOW MIX TALL (By Native American Seed)	95	20
MEADOW MIX SHORT (By Native American Seed)	95	20
COMMON BERMUDA	95	20

Note: % Pure Live Seed = % Purity X % Germination

C. Weed seed shall not exceed 10% by weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weed seed will not be allowed.

D. If Native American Seed Mixes seeding seasons are missed the contractor will be required to seed Perennial Rye at a rate of 15 pounds per acre and return the following season to install the specified grass at no cost to the owner.

2.2 FERTILIZER FOR TANK MIX

A. MicroLife Multi-Purpose 6-2-4, pelleted, uniform in composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warranty of the producer.

2.3 WOOD CELLULOSE FIBER MULCH

A. Wood Cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed in such a manner that it will not contain germination or growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to 18% moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements.

2.4 WATER

A. Drinkable, directly from local utility supply.

2.5 SLURRY MIX COMPONENTS PER ACRE

A. Wood Cellulose Fiber Mulch 2,000 pounds

B. Grass Seed (as specified)

C. Fertilizer (13-13-13) 800 pounds

2.6 SOD

A. One year old sod, ref. planting schedule for sod selection. Sod shall be dense with the grass having been mowed at 1" height before lifting from field. All grown on fumigated soil. Sod shall be in vigorous condition, dark green in color, free of disease and harmful insects. Do not stack for more than 24 between time of cutting and time of delivery. Owner's representative reserves the right to reject any sod deemed unacceptable for installation.

2.7 TOPDRESS FERTILIZER

A. (Delayed Application) Complete fertilizer, 50% of the nitrogen shall be derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bone, or tankage. Potash shall be derived from muriate of potash containing 60% potash. Apply at rate to achieve 1.5 # N/1000sf.
1. 16% Nitrogen
2. 6% Phosphoric Acid
3. 8% Potash

2.8 TOPDRESS MIX

A. Topdressing under existing trees shall be:
1. 2/3 Cubic Yard Planting Soil-Ref. 32 9100
2. 1/3 Cubic Yard Sand-Ref. 32 9100

PART 3 - EXECUTION

3.1 HYDROMULCH SEEDING OF BERMUDA GRASS AND PRAIRIE SEED ON PREPARED FINISHED GRADE

A. Bed Preparation:

1. Ref. Soil Preparation 32 91 00
2. Rake or Harrow 3”-4” deep

B. Hydroseeding:
   1. Immediately after the finished grade has been approved, begin hydroseeding operation to reduce excessive weed growth.

C. Perimeter Sodding:
   1. Install two courses of sod at perimeter of area to receive hydroseeding. Install in compliance with requirements of “SODDING ON PREPARED FINISHED GRADE” requirements below.

D. Special Mulching Equipment and Procedures:
   1. Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing up to 40 pounds of fiber plus a combined total of 70 pounds of fertilizer solids for each one 100 gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles, which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of 800 gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Owner’s representative may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

E. Mixing:
   1. Care shall be taken that the slurry preparation takes place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good re-circulation shall be established and seed shall be added. Fertilizer shall then be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence immediately when the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

F. Application:
   1. Obtain approval of hydromulch area preparation from the Owner’s representative prior to application.
   2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.
   3. Keep hydromulch within areas designated and keep from contact with other plant material.
   4. Slurry mixture which has not been applied within 4 hours of mixing shall not be used and shall be removed from the site.
   5. After application, do not operate equipment over the covered area.
   6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.

7. Refer also to the maintenance portion of this Section.

G. Unseeded Areas: Reseed unplanted areas with the specified grasses at no additional cost to the Owner.

3.2 DRY APPLICATION SEEDING FOR NATIVE GRASS/BERMUDA GRASS MIXES

A. Seed Bed Preparation:
1. Ref. Soil Preparation 32 91 00
2. Rake or Harrow 3”-4” deep

B. Seeding:
1. Plant seed with a broadcast seeder or a Culti-packer seeder. Plant grass seed no deeper than ¼ inch and the distance between rows 12 inches or less. Distribute seed evenly.
2. Roll the planted seedbed with a Culti-packer immediately after seeding and prior to applying mulch cover.
3. Seed may be broadcast by hand for small areas or areas inaccessible to seeding equipment, as approved by the Engineer. Areas seeded by hand shall be rolled or lightly compacted, if possible.

C. Mulching:
1. Spread straw or hay mulch on seeded areas with a slope steeper than 8H:1V immediately after application of seed.
2. Apply straw or hay mulch at a rate per acre of 2000lbs., to create a uniform mat of coverage a minimum of ½ inch thick to protect the seedbed.
3. Secure straw or hay mulch with hydromulch or other approved methods.
   a. Apply a hydromulch, consisting of a homogeneous aqueous mixture of recycled paper fiber, water and tackifier or soil stabilizer, to achieve a rate of 1,000 pounds of paper fiber mulch per acre over the straw mulch. Apply guar gum tackifier at a minimum rate of 50 pounds (dry weight) per acre.
   b. Application rate for other tackifier or soil stabilizer compounds shall be in accordance with the manufacturer’s recommendations and approved by the Engineer.

3.3 SODDING ON PREPARED FINISHED GRADE

A. Bed Preparation:
1. Ref. Soil Preparation 32 91 00
2. Immediately after the finished grade has been approved, begin sodding operations to reduce excessive weed growth. If sod bed is dry immediately prior to sod installation, dampen surface with a fine mist of water.

B. Installation:
1. Lay sod so that adjacent strips butt tightly with no spaces between strips. Lay sod on mounds and slopes with strips parallel to contours. Stagger joints. Sodded areas shall be flush with adjoining seeded areas. At walks and pavements lay one strip of sod parallel to pavement and make cuts at this strip. At back of curb there shall be a double sod strip totaling 36” so that it can be maintained with a 36” wide mower deck.
2. Tamp and roll sod thoroughly to make contact with sod bed.
3. Peg sod on slopes three to one or steeper with pegs driven through sod into soil until pegs are flush with turf. Space pegs 18” on center. Pegs shall be 1" square by 6" pine or 6" lengths of lath.
4. Water sod thoroughly immediately after fertilizing.

5. Roll sod with 200 lb ballast roller immediately after sod has been installed and watered.

3.4 CLEAN UP

A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during lawn installation operations. Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Owner's representative.

3.5 INSPECTIONS

A. Make written request for inspection prior to seeding and after areas have been seeded and sodded.

B. Submit requests for inspections to Owner's representative at least 2 days prior to anticipated inspection date.

END OF SECTION 32 92 00

SECTION 32 92 23
SODDING FOR EROSION CONTROL

1. DESCRIPTION:

"Sodding for Erosion Control" shall consist of providing and planting Bermuda grass or other acceptable sod along or across such areas as are designated on the plans and in accordance with specification requirements herein outlined.

2. MATERIALS:

The sod shall consist of live, growing Bermuda grass or other acceptable sod secured from sources where the soil is fertile. Bermuda sod shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for a thickness of at least three inches (3"). St. Augustine sod shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for a minimum thickness of one inch (1"). The Contractor shall not use sod from areas where the grass has been thinned, nowhere the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grown when transplanted. The sod shall be free from noxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and ranked to remove all weeds and long-standing stems. Sources from which sod is to be secured shall be approved by the Engineer.

Care shall be taken at all times to retain the native soil on the roots of the sod during the process of excavating, hauling, and planting. Sod material shall be kept moist from the time it is dug until planted. When so directed by the Engineer, the sod existing at the source shall be watered to the extent required prior to excavating.

2.1 Planting Season:

All planting shall be done between the average date of the last freeze in the spring and six weeks prior to the average date for the first freeze in the fall according to the Texas Almanac or U.S. Weather Bureau for the area in which the project is located, except as specifically authorized in writing.

2.2 Fertilizer:

Fertilizer shall conform to the requirements of Texas Department of Transportation Standard Specification Item 166, "Fertilizer." The fertilizer shall be standard pelleted or granulated commercial fertilizer supplied separately or in mixture containing the percentages of total nitrogen, available phosphorus acid, and water-soluble potash at the rate of 13-13-13. The fertilizer shall be applied at the rate of three hundred (300) pounds per acre.

2.3 Straw Mulch:

Straw mulch shall be oat, wheat, or rice straw, prairie grass, Bermuda grass, or other hay approved by the Engineer. The hay shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted.

2.4 Asphaltic Material:

Asphaltic material shall be of the type and grade shown on the plans and shall conform to the requirements of Texas Department of Transportation Standard Specification Item 300, "Asphalts, Oils, and Emulsions."

3. CONSTRUCTION METHODS:

After the designated areas have been completed to the lines, grades, and cross-sections shown on plans and as provided for in other items of this contract, sodding of the type specified shall be performed in accordance with the requirements hereinafter described.

3.1 Watering:

The sodded areas shall be watered at such times and in the manner and quantity as directed by the Engineer.

3.2 Finishing:

Where applicable, the shoulders, slopes and ditches shall be smoothed after planting has been completed and shaped to conform to the desired cross-sections. Any excess dirt from planting operations shall be spread uniformly over adjacent areas or disposed of as directed by the Engineer so that the completed surfaces will present a neat appearance.

4. SPOT SODDING:

4.1 Bermuda:

Furrows parallel to the roadway and approximately five inches (5") deep and eighteen inches (18") on centers shall be opened on areas to be sodded. In two furrows adjacent to the roadways, sod shall form a continuous row not less than three inches (3") wide. In all other furrows, sod approximately three inches (3") square shall be placed on fifteen inch (15") centers.

Unless otherwise indicated on the plans, fertilizer shall be applied uniformly in the furrows or rows in accordance with the applicable provisions of Texas Department of Transportation Standard Specification Item 166, “Fertilizer.”

4.2 St. Augustine:

Prior to planting, the area to be sodded shall be reshaped by blading or other approved methods to the final finish desired. St. Augustine grass sod shall be not less than three inches (3") square and shall be planted on a maximum of eighteen inch (18") centers. Planting of the sod may be in furrows of uniform depth or in holes of like depth. Sod shall be placed so that when it has been firmed against the bottom of the furrow or hole, the top of the sod shall not be more than 1/2 inch below finished grade. Soil shall be firmed against all sides of the sod and covering of the sod will not be permitted except for small amounts of soil incidental to raking or leveling provided the quantity of soil is not enough to hinder growth in the opinion of the Engineer. Unless otherwise indicated on the plans, fertilizer shall be applied uniformly in the furrows or holes in accordance with the applicable provisions of Texas Department of Transportation Standard Specification

Item 166, "Fertilizer."

5. BLOCK SODDING:

At locations shown on plans or where directed, sod blocks shall be carefully placed on the prepared areas. The fertilizer shall then be applied in accordance with the applicable provisions of the Item, "Fertilizer" and thoroughly watered. When sufficiently dry, the sodded area shall be rolled or tamped to form a thoroughly compacted, solid mat. Any voids left in the block sodding shall be filled with additional sod and tamped. Surfaces of block sod, which, in the opinion of the Engineer, may slide due to the height and slope of the surface or nature of the soil, shall upon direction of the Engineer, be pegged with wooden pegs driven through the sod blocks into firm earth sufficiently close to hold the block sod firmly in place. Edges along curbs and drives, walkways, etc., shall be carefully trimmed and maintained until accepted.

6. GRASS RETARDS:

Trenches shall be excavated across the side ditches or along the side or back slopes to the lines and dimensions shown on plans. After the trenches have been prepared, they shall be filled with sod blocks to an elevation flush with the adjacent ground surface. The fertilizer shall then be applied in accordance with this section. When sufficiently dry, the sodded area shall be rolled or tamped to form a thoroughly compacted, solid mat. Any voids left between the sod blocks shall be filled with additional sod and tamped.

7. BROADCAST SPRIGGING:

Except on areas recently loosened by construction, all ground on which sprigging is to be placed shall be loosened by disking or other approved methods to a depth of not less than four inches (4"). All large clods shall be pulverized and boulders, rocks or other debris shall be removed as directed. The Contractor shall take full advantage of weather conditions, but the work may be suspended when, in the judgment of the Engineer, the continuation of the same may result in unfavorable planting conditions.

The sod source shall be disked in two directions, cutting the sod thoroughly to a depth of approximately four inches (4"), which shall be the maximum depth of excavation. The disked sod may be windrowed, or otherwise handled in a manner satisfactory to the Engineer. Sod material shall be loaded in such manner as to avoid taking soil containing no roots. The material shall be rejected if not kept in a moist condition.

The sod shall be uniformly spread over the prepared area at the rate of approximately one (1) cubic yard per twenty-four (24) square yards of area. Fertilizer shall be uniformly distributed over the area in accordance with the applicable provisions of the Item, "Fertilizer". The area shall then be disked immediately in order to thoroughly incorporate the grass with the soil. Then the area shall be finished in accordance with Article 3 and the planted area shall be rolled with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour.

8. MULCH SODDING:

The sod source shall be disked in two directions, cutting the sod thoroughly to a depth of not less than four inches (4"). Sod material shall be excavated to a depth of not less than four inches (4") or more than ten inches (10"), being careful to avoid having soil containing no grass roots. The disked sod may be windrowed, or otherwise handled in a manner satisfactory to the Engineer.

The material shall be rejected if not kept in a moist condition.

Prior to placing mulch sod, the cut slopes shall be scarified by plowing furrows four inches (4") to six inches (6") deep along horizontal slope lines at two foot (2') vertical intervals. Excavated material from the furrows shall not protrude more than three inches (3") above the original surface of the cut. Fertilizer shall be distributed uniformly over the area in accordance with the applicable provisions of the Item "Fertilizer". The sod shall then be dumped upon the prepared area and spread uniformly to the required approximate thickness shown on plans.

Any section not true to lines and cross-sections shall be remedied by the addition of sod material or by reshaping the material to meet the requirements of "Finishing" in Article 3. After the sod material has been spread and shaped, it shall be compacted with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour.

9. STRAW MULCH:

Where applicable, "Spot Sodding", "Broadcast Sprigging" and "Mulch Sodding" shall have straw mulch spread uniformly over the area indicated on plans or as directed by the Engineer. The rate of application shall be 1-1/2 to 2 tons of hay or 2 to 2-1/2 tons of straw per acre. A mulching machine approved by the Engineer shall be equipped to inject asphaltic material uniformly into the straw as it leaves the equipment at a rate of 0.05 to 0.10 gallons of asphalt per square yard of mulched area or as directed by the Engineer. If the straw and asphalt are placed by hand, then the rate of application for asphalt shall be approximately 0.15 gallons per square yard of mulched area.

10. MEASUREMENT:

Work and acceptable material for "Spot Sodding", Block Sodding", "Grass Retards", "Straw Mulch", will be measured by the square yard complete in place. Work and acceptable material for "Broadcast Sprigging" and "Mulch Sodding" will be measured by the square yard complete in place.

11. WARRANTY:

The contractor will guarantee a ninety-five percent (95%) cover of grass species planted. The Contractor will not have liability if the stand of grass is destroyed by a natural disaster, such as a flood.

END OF SECTION

SECTION 32 93 00 - PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants.
2. Tree stabilization.
3. Tree-watering devices.
4. Landscape edgings.
5. Landscape mulches and gravels

B. Related Requirements:
1. Section 32 9200 "Lawns and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.
2. Section 32 9100 “Soil Preparation”

1.2 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
3. Irrigation inspection tube and cap materials.
4. Fertilizer tablets for tree installation

B. Samples for Verification: For each of the following:

1. Mulch: 1-quart volume of mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

2. Planting Soil Mix: 1-quart volume of mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
3. Weed Control Barrier: 12 by 12 inches.
4. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
5. Tree Staking Materials and Accessories: post, hose, and webbing (sample of each)

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in landscape installation in addition to requirements in Section 01 4000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Interior.
    c. Landscape Industry Certified Horticultural Technician.

5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants shall be made by Architect, who tags plants at their place of growth before they are prepared for transplanting.

C. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

H. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.

2. Warranty Periods: From date of Substantial Completion.

a. Trees: 1 year.
b. Shrubs, Vines, Ornamental Grasses, Ground Covers, Biennials, Perennials, and Other Plants: 1 year
c. Sod:1 year
d. Annuals: Three months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Annuals: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.2 FERTILIZERS

A. Trees: Ref 32 9100 “Soil Preparation” for fertilizer selection

B. Shrub, groundcover, annuals and perennials: MicroLife all organic fertilizer as supplied by San Jacinto Environmental (713) 957-0909. Apply at mfg. max. recommended rates. Ref. Section 32 9100- “Soil Preparation”

2.3 MULCHES

A. Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Hardwood mulch
2. Grind: 1.5”x2”max, Double Ground
3. Color: Natural (Brown)
4. Depth: 1.5” min 3.5” maximum

B. Compost: Ref 32 9100 “Soil Preparation”

2.4 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.

B. Miriafi 140 NL as manufactured by Nicolon Mirafi Group, Pendergrass, GA, (888) 795-0808 or approved equal.

2.5 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer. Cross reference with 32 9100-Soil Preparation

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.6 TREE-STABILIZATION MATERIALS

A. Stakes and Guys:

Contractor shall use staking materials necessary to meet requirements of specifications, subject to approval:

1. Tree Stakes: 7' & 8’ long steel T-post weighing 1.33 pounds per foot.
2. Paint for Stakes: Pittsburgh Paint No. 515-5 Stonehenge Greige.
3. Tie Webbing: Tree Tie Webbing by AM Leonard-Green
4. Rootball Fixing Sub Surface Anchors: Platipus Anchors RF2P 3-Leg

2.7 LANDSCAPE EDGINGS

A. Concrete Edging: Ref. Materials Schedule

2.8 MISCELLANEOUS PRODUCTS

A. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils thick, with vertical root deflecting ribs protruding 3/4 inch out from panel, and each panel 24 inches wide.

B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

C. Burlap: Non-synthetic, biodegradable.

D. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.

E. Planter Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

F. Mycorrhizal Fungi: Dry, granular inoculants containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable, and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.3 PLANTING AREA ESTABLISHMENT

A. Loosen subgrade of planting areas to a minimum depth of 8 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.
2. Thoroughly blend planting soil off-site before spreading.

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil to a depth indicated on the Drawings.

    a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.

B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at maximum application rate recommended by manufacturer.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
1. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
3. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
4. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
5. Maintain supervision of excavations during working hours.
6. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
7. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Follow Soil Preparation Execution. Ref. 03 9100

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Use Blended Planting Soil for backfill. Follow Soil Preparation Specification. Ref. 329100
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Follow Soil Preparation Specification. Ref. 039100 for fertilization.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Set balled and potted, and container-grown stock plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Use Blended Planting Soil for backfill. Follow Soil Preparation Specification. Ref. 329100
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Follow Soil Preparation Specification. Ref. 039100 for fertilization.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

3.6 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.7 TREE STAKING

A. Staking of trees is to be used by the Contractor, who will be responsible for material remaining plumb and straight for all given conditions through the guarantee period. Tree support shall be done as outlined on the following tables.

B. Staking shall be completed immediately after planting. Plants shall stand plumb after staking.

C. Stake all trees in accordance with the following table:

Tree	Stakes	Stake Size
15-45 Gal. and B&B under 3”	2	6 ft Post
65 Gal. and B&B 3”& larger	3	7 ft Post

D. Locate first stake on prevailing windward side of tree and as close to the main trunk as is practical, avoiding root injury. Stakes shall be driven at least 18" into firm ground.

E. Tie tree to stake using approved tree tie. Tie shall be located midway within tree crown or at a location approximately 2/3 of the overall height of the tree. Locate tie just above major side branch in order to deter slippage of tie.

F. Locate second stake opposite first. Secure with one tie opposite upper tie at first stake.

G. Auxiliary stem stakes shipped with trees shall be secured as above after shipping.

3.8 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings. Deep Root 24-2 or approved eq.

B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.

1. Position top of root barrier flush with finish grade.
2. Overlap root barrier a minimum of 12 inches at joints.
3. Do not distort or bend root barrier during construction activities.

4. Do not install root barrier surrounding the root ball of tree.

3.9 GROUND COVER AND PERRENIAL PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on the Drawings

B. Use planting soil for backfill. Follow soil preparation execution. Re. 329100

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Tree-like Shrubs in Turf Areas: As indicated on the Drawings or 3”depth
2. Organic Mulch in Planting Areas: As indicated on the Drawings or 3”depth
3. Mineral Mulch in Planting Areas: As indicated on the Drawings

3.11 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

D. Reference the Maintenance Specification 329400 for further information.

3.12 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas. Ref. 32 9100-Soil Preparation for clarifications.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations. Ref. 32 9100-Soil Preparation for clarifications.

3.13 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.14 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 32 93 00

SECTION 32 94 00 - LANDSCAPE GROUNDS MAINTENANCE FOR NINETY (90) DAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: The Drawings, Division 0 and Division 1 apply to work under this Section.

1.2 SCOPE OF WORK:

A. Work included in Base Bid:

1. Monitoring adjustment and minor repair of the landscape irrigation system.
2. Mowing, edging and trimming of lawn areas.
3. Mowing of Love Grass and Native Grass Plantings
3. Pruning and trimming of plant materials.
4. Weed, cultivating and cleaning of planting beds, turf areas, and Native grass areas..
5. General site clean up; removal of trash and products of maintenance.
6. Applications of fertilizers, ant control, insecticides and herbicides.
7. Pruning and trimming of trees.
8. Mulching trees, shrubs, groundcovers and seasonal color.
9. Extra services as needed.

B. Work Not Included in Base Bid: (Extra Service)

1. Street cleaning - other than that required as a result of maintenance operations.
2. Replacement of plant material - other than that required under the one year warranty requirement.
3. Compost amendment application
4. Aerating lawn areas.
5. Overseeding with cool-season grasses.
6. Application of pre/post emergents.
7. Additional clean-up and/or plant material replacement relating to natural weather events including hurricanes, tornadoes, severe thunderstorms, major rain events causing flooding, freezing temperatures, ice/ice storms, extended periods of draught and snow.

1.3 EXTRA SERVICES:

The intent of the ninety day maintenance period is to provide a comprehensive maintenance program to include all required services, except those services specifically excluded, to perform the work for the stated time period.

1. All services not included in the list of Base Bid items shall be considered 'extra services" and will be charged for separately according to the nature of the item of work. The consent and authorization of the Owner’s representative or their authorized representative must be obtained prior to the performance or installation of such "extra services" items and prior to purchase of any chargeable materials.

2. Such work may include replacement of dead plant materials other than what is already covered under the warranty period, major repairs of irrigation system, by-products of vandalism or other contracts or other site related work.

3. Application of pre/post emergents.

4. Authorized extra services work must be summarized weekly and submitted with receipts to the Owner's representative.

5. The Owner's representative is not bound by the specifications or contract to utilize the landscape maintenance contractor in the performance of "extra services" work.

6. The landscape maintenance contractor shall coordinate his activities with other contractors on the site so as to not hinder the performance of any work.

6. Authorized charges for extra work will be paid per the General Conditions of the Contract.

1.4 SUBSTITUTIONS:

A. Specific reference to manufacturer's names and products specified in this Section are used as standards, but this implies no right to substitute other material or methods without written approval of the Owner's representative. Such permission must be secured without additional cost to Owner's representative.

B. Installation of any approved substitution is Contractor's responsibility. Any changes required for installation of any approved substitution must be made to the satisfaction of and without additional cost to Owner's representative.

1.5 INTENT OF THE MAINTENANCE PROGRAM:

It is the intent of the maintenance program is to provide the Owner's representative with a project site that is attractive in appearance and keep all plant materials and lawns in a healthy and vigorous condition.

1.6 THE CONTRACT:

This Maintenance Contract is a period ninety days. The Contract can be terminated with cause.

1.7 CONTRACTORS PERFORMANCE:

The Contractor shall perform all work required once per week or as often as necessary to fulfill the spirit and intent of the Contract. The workmen shall be dressed in company uniforms and all required PPE (Personal Protective Equipment), and neat in appearance, perform their work in a professional manner, keep noise to a minimum and stage their work from a location on the site out of the way of the mainstream of the users. In general, the Contractor's presence on the site shall be as inconspicuous as possible.

1.8 COMMENCEMENT OF THE MAINTENANCE PERIOD:

This maintenance period shall become effective at the date of Substantial Completion.

1.9 NEGLECT AND VANDALISM:

1. Turf, shrubs, trees or plants that are damaged or killed due to contractors operations, negligence or chemicals shall be replaced at no expense to the Owner's representative. If plant damage or death is caused by conditions beyond the contractor's control, replacement shall be at the Owner's representative's expense.

2. Sprinklers or structures that are damaged due to the contractor's operations must be replaced by the contractor promptly. Likewise, damage to the irrigation system by others shall be corrected immediately by the contractor, at the Owner's representative's expense.

3. All water damage, either natural or man-made, resulting from contractor's neglect shall be corrected at the contractor's expense.

4. All damage to or thefts of landscaping and irrigation installations not caused or allowed by the contractor shall be corrected by the contractor at the Owner's expense upon receipt of written authorization to proceed.

1.12 EMERGENCIES:

1. The Contractor shall answer emergency or complaint calls within twelve (12) hours and corrective action shall be complete within twenty-four (24) hours.

2. The Contractor shall answer emergency calls regarding the Landscape Irrigation system failure or need of repair, and take corrective action within eight (8) hours. Such work, unless caused due to neglect on the part of the Landscape Maintenance Contractor, shall be considered "Extra Services".

1.13 JOB CONDITIONS:

A. Contractor shall be familiar with all site conditions.

1.14 RESTRICTIONS:

A. Do not use growth regulators or growth retardants or any chemicals that will have adverse effects on the organic fertilizers and soil conditioners utilized for this project.

PART 2 - PRODUCTS AND MACHINERY

2.1 MATERIALS:

Materials listed under this Section are expressly requested for use and does not prohibit or restrict the Contractor from providing other materials not listed in order to complete the work required herein.

1. Pre-Emergence Weed Control: Shall be Surflan A.S., Atrazine 4L or approved equal.

2. Post-Emergence Weed Control: Shall be Trimec Lawn Weed Killer, Sedge Hammer, Vantage, Image or approved equal.

3. Sufactant: Spreader Sticker shall be used with both pre and post emergence herbicides.

3. Herbicide: Shall be "Round Up", by Monsanto, St. Louis, Missouri.

4. Insecticide: Shall be Shall be "Astro Insecticide" as manufactured by FMC Corporation, Agricultural Products Group, 1735 Market Street, Philadelphia, PA 19103 (800.321.1362) or approved equal.

5. Fire Ant Control: Ortho Orthene Fire Ant Killer.

6. Compost: Made from recycled natural materials screened to 1" minus (for soil additive). On the Solvita compost maturity test score, must score a value of 5 or higher for tilling into the soil and be a minimum of 6 months old and fully composted. Supplied by Nature's Way Resources, Inc., Conroe, Texas or approved equal.

7. Fertilizer: FERTILIZERS AND NUTRIENT AMENDMENTS:

   A. Fertilizer: MicroLife Hybid 20-0-5, MicroLife Ultimate 6-2-4, and MicroLife Humates Plus 0-0-4 as supplied by San Jacinto Environmental Supplies, Houston, Texas or other approved equal supplier.
   B. Contractor shall keep all empty bags with certificates intact and submit them to the Owner's representative.
      1. Submission of empty fertilizer bags is required to verify operation has been performed as specified.
   C. Humate Soil Conditioner: Vigoro modified humate, Earthgreen Menefee Humate, Humate International AG 16-35 or approved equal.
   D. Aerated Compost Tea: Natures Own or approved equal.

8. Tree Deep Feeding Fertilizer: Shall be Aerated Compost Tea with mycorrhizal fungi manufactured by Natures Own, MicroGrow or approved equal

9. Fungicide: Shall be "Systemic Fungicide" with Benomyl by Greenlight Products, San Antonio, Texas 78217, and/or Cleary Chemical 3336 WP "Turf and Ornamental Fungicide.

10. Fertilizer for annuals/perennials:

    Nelson ColorStar Plus 19-13-6 with Fungicide

    Foliar spray Maximum Blooms 3-8-3 Organic liquid color fertilizer

11. Soil Drenching Material: Shall be "Sub Due 2E", by the Agricultural Division of Ciba-Geigy Corporation, Greensboro, North Carolina 27409.

12. Mulch: Shall be equal to that already in use at the site. Shredded hardwood bark for groundcover areas.

13. Tree Stakes and Guys: Shall match those in use at the site.

2.2 MACHINERY:

Machinery requirements listed under this Section are not intended to be restrictions of specific manufacturers or models unless so stated. Specific mention of manufacturers is intended as a guide to illustrate the final product of maintenance operations desired.

1. Lawn Mowers: Shall be of the rotary type in good working order, finely tuned to protect the lawn from excessive exhaust fumes. Blades shall be sharp to reduce shredding of the cut grass blades.

2. Lawn Edgers: Shall be of a rigid or flexible blade type that will produce a fine clean edge where lawns meet walkways, pavements or curbs.

3. Fertilizer Spreaders: Cyclone type spreader or equal. No visible underlapping of applications will be permitted.

4. Deep Root Feeder: Shall be the Ross type by Ross Daniels, Incorporated, Des Moines, Iowa 50265.

5. Pruning Tools: Shall be maintained in good working order, cutting edges shall be sharp. Disinfect all tools when used for the removal of diseased limbs.

PART 3 - EXECUTION

3.1 LANDSCAPE IRRIGATION SYSTEM:

The Contractor shall monitor and program the automatic controlling devices to proceed optimum moisture levels in all planted areas.

1. Irrigation cycles shall be set to take place prior to sunrise (usually 4:00 - 5:00 am) unless otherwise instructed by the Owner’s representative, except during visits of grounds maintenance personnel; during such visits the irrigation system may be operated as desired by those personnel.

2. Do not program controllers operating on the same water meter to water during the same time period so as to prevent over-draft of water meters. Do not switch controller to "off" at any time, except as required for testing and for maintenance operations.

3. Complete sprinkler system servicing shall be performed as required to maintain sprinklers in correct operating condition, including all required labor. Monitor and inspect sprinklers once a month or upon request of the Owner’s representative. This check shall include visual "inspection" of all accessible components of the irrigation system including but not limited to controllers, remote control valves, quick couplers and heads.

4. Adjust sprinklers to avoid damage to automobiles, signs and also adjust heads to keep water off the street and sidewalks. Make repairs and alterations to the sprinkling system and water lines. All sprinklers repairs such as cleaning of heads or breaks caused by the Contractor shall be the Contractor's responsibility.

5. Minor repairs: Contractor shall make necessary repairs under $300.00 without Owner’s representative's approval to maintain operation of the system.

6. Replacement materials throughout the system shall be as specified in Section 02810.

3.2 TREES MAINTENANCE:

A. Contractor shall maintain staking and guying of trees at all times and shall be responsible for any damage to trees or plant materials caused by chafing or breakage of foliage or limbs coming in contact with stakes or ties. Replace broken plant stakes and ties and bent stakes as needed. If ties are too tight, they must be replaced or adjusted. If stakes are not needed, remove.

B. Trees that may require guys, stakes or special care during the winter winds and rains shall receive the required care prior to the time of rains and high winds to insure that no damage results to the plant material.

C. All suckers shall be continually removed from trees.

3.3 SEASONAL AND PERENNIAL FLOWERS:

A. The maintenance contractor shall continually maintain seasonal flower beds in all contract areas.

B. Complete weeding, trimming, edging, and cultivation of all flower beds as required to keep the beds free of weeds, to promote growth and maintain neat, orderly appearance. As flowers cover open soil, cultivating shall be discontinued.

C. Maintenance shall include:

1. Pinching of blooms and pruning of dead or damaged foliage.

2. Fertilize in alternate months with organic fertilizer. (RE: PART 2)

3. Apply supplemental organic fertilizer to keep each type of seasonal flower performing at its optimum level.

4. Spraying or dusting for disease or insect control as a preventive or corrective measure.

5. Seasonal Color Change out: seasonal color change out after the initial planting (Extra Service) by the installing contractor.

D. Fertilizer for annuals/perennials: Add ColorStar Plus 19-13-6 with Fungicide at the manufacturers recommended rate and feeding schedule. Foliar spray Maximum Blooms 3-8-3 Organic liquid color fertilizer (6 ounces per 1000 sq ft) & Garlic Oil (1 ounce per 1000 sq ft) mixed together with water and sprayed every 30 days.

3.4 HEDGE MAINTENANCE:

A. Edge, weed, fertilize and cultivate all hedge beds in accordance with Schedule.

B. Pruning of shrubs should create a uniformly dense plant, trapezoid in shape. Height as approved by Owner's representative. Selectively thin and tip back annually. Prune to enhance natural branching effect of plants. Do not change shape of shrubs by pruning.

3.5 GROUNDCOVER BEDS:

A. Complete weeding, trimming, edging, and cultivating of all groundcover as required to keep the beds free of weeds, to promote growth and maintain neat, orderly appearance. As groundcovers cover open soil, cultivating shall be discontinued.

B. Groundcover beds bordering on paved surfaces must be edged as needed to retain a neat edge. Do not trim vertically so as to expose stems and thatch.

C. Fertilize all groundcovers with complete commercial fertilizer four times per year. (Extra Service)

D. Replant all damaged or thin areas in groundcover beds at direction of the Owner's representative, at proper spacing.

E. Slopes of 2:1 ratio, or steeper, shall not be cultivated due to erosion nuisance, unless otherwise instructed to cultivate by the Owner's representative.

3.6 TURF MAINTENANCE:

A. Mowing: During periods of mild weather, mow at one and one-half (1 1/2") inches but during hot weather, the cut should be not lower than two (2") inches from the soil. Regular weekly mowing is required. Never scalp the lawn or cut more than one half the existing top growth in one mowing. Remove or catch the clippings, never allowing clippings to remain on lawn surface more than four (4) hours.

Allow grass to grow up to but not over sprinkler heads. Trim grass around heads with a circular sprinkler head trimmer. DO NOT USE LINE TRIM AROUND SPRINKLER HEADS.

B. Watering: Provide a regular, deep watering program. The established turf should not be kept wet but should dry out somewhat between waterings. A twice weekly watering is good under regular conditions, but if it is hot or windy, water more often. In very hot weather, a fast watering with fine spray will cool the turf zone and can supplement the regular, deeper watering program. In shaded areas caused by trees or shrubs, water more frequently because of the competition for soil moisture. If lawn wilts (shows grey-brown) water more frequently.

C. Lawn Fertilizer: Analysis based upon soil sample.

March 1	MicroLife Hybird 20-0-5 applied at manufacturer's maximum recommended rate.
May 25	MicroLife Humates Plus 0-0-4 at manufacturer's maximum recommended rate.
July 18	Same as the March application.
October 11	MicroLife (6-2-4) at manufacturer's maximum recommended rate.

D. Weed Control: Contractor shall use extreme care in the use of chemicals for weed control. Before such applications are made, the turf should be well established and in a vigorous condition. Broadleaf weeds such as malva, dandelion and plantain can be controlled with

applications of selective and recommended herbicides. Always follow label directions fully and carefully; wash sprayer carefully after using herbicides.

E. Insects: Control insects with regular applications of commercial insecticides at the manufacturer's recommended rate. Spray for insects once a month from mid-spring through summer as a preventative measure.

F. Diseases: When they first appear, spray for diseases with an approved commercial fungicide strictly according to the manufacturer's recommendations.

3.7 NATIVE GRASSES MAINTENANCE

A. Native grass mixes – Twice annually on or about June 1st and January 1st
B. Above grasses shall be mowed to a 6” height.

3.8 CONTROL OF NOXIOUS WEEDS (Johnson Grass, Nut Grass, Poison Ivy, and other Noxious Weeds.)

A. Noxious weeds shall be killed by using "Round Up" or other spray as approved by Owner’s representative. Spray only foliage of grass to be eradicated, as this spray will kill any plant that it contacts.

B. Irrigation to sprayed area should remain "off" for a period of three days following spray application. Repeat spray as required to kill completely.

C. Apply pre/post-emergent weed killer as per manufacturer's recommendation as required by the "Schedule" and approved by Client prior to application.

C. Weeds 30” or taller shall be removed/eradicated in Native Grass zones.

3.9 USE OF HERBICIDES, INSECTICIDES, AND STERILANTS:

A. The Contractor is hereby granted permission to use such herbicides, insecticides, and sterilants as it may find necessary and advantageous in its grounds maintenance activities. Herbicides, insecticides, and sterilants, must be used responsibly and in conformance with Federal, State, and Local laws and regulations. The Contractor assumes all liability for damage and/or injury resulting from accident or misuse of these products and/or equipment. The Owner’s representative retains the right to prohibit the use of any herbicide, insecticide, and sterilant that he may judge to be undesirable for any reason.

B. Products leaving an undesirable residue or odor (i.e., weed oil) shall not be used.

C. The Owner’s representative shall be notified prior to application and advised of any danger associated with the use of these products (i.e., to avoid personal contact with sprayed areas, etc.).

D. Apply insecticides as needed to protect all plant materials from damage. The insect control program shall include slugs and snails and advance preventive spraying for twig borers. The Contractor shall be responsible for the choosing of chemicals and insecticides he uses and shall be accountable for any misuse of same.

E. Apply the proper fungicide, herbicide and pesticides for the control of pests, weeds and plant diseases or treat cuts on exposed surfaces of trees or shrubs for disease and pest control on turf, plants and trees.

3.10 GENERAL CLEAN UP:

A. The Contractor shall dispose of all waste materials or refuse from his operations legally off the property except where agreement is reached with the Owner's representative.

B. All plant growth shall be prevented in any cracks in walks or within paved areas.

C. Leaves, papers, grass clippings or other debris shall be removed at least weekly or at each visit from all areas.

D. Trash receptacles shall be checked regularly and emptied, and trash removed from the site frequently enough so that trash never overflows the receptacles. Trash receptacles shall be lined with black plastic bags which shall be emptied and removed from the site daily.

PART 4 - SCHEDULE

4.1 SCHEDULE:

The Schedule as included herein shall govern the work. Should the Contractor require an alteration of the Schedule, contact the Owner's representative.

JANUARY: WEEKS 1, 2, 3, 4

TURF

The turf shall be watered as needed. Turf shall be raked during the latter part of the month, to remove thatch. Mow turf for the first time in week 4.

TREES, SHRUBS, AND VINES

Trees shall be pruned except flowering trees and flowering shrubs which shall be pruned after flowering. Do not change shape of tree, prune to enhance shape. Pre-emergent herbicides shall be applied if approved by Client. Weed beds as required.

FEBRUARY: WEEKS 1, 2, 3, 4

TURF

The turf shall be watered as needed. Turf shall be raked during the latter part of the month, to remove thatch. Mow turf weeks 2 and 4.

TREES, SHRUBS, AND VINES

Continue pruning trees. Apply tree fertilizer to established trees. Deep root feeding is method to use during this period. Iron and other elements shall be applied if needed. Fertilize acid loving plants as called out under "Material Used". Do not fertilize flowering shrubs until blooming is completed.

MARCH: WEEKS 1,2

TURF

Turf shall be mowed in week two. Mowing shall not remove more than one-quarter (1/4") inch off existing height. First application of fertilizer (Microlife Hybid 20-0-5) shall be applied at manufacturer's maximum recommended rate. Water thoroughly after applying fertilizer. Mow first; then fertilize.

TREES, SHRUBS, AND VINES

Check Plants for adequate watering to prevent any winter damage. Water if necessary. Prune dead wood as required. Continue to weed beds.

Mulch shall be placed in all beds, a two (2") inch to three (3") inch layer over existing mulch if mulch is not adequate. Dead vines should be removed. Flowering plants should be fertilized only after blooming.

MARCH: WEEKS 3, 4

TURF

Mow as required; still only one-quarter (1/4") inch off existing growth. Water as required. Weed control should be continued. Replace any winter damaged sod at this time.

TREES, SHRUBS, AND VINES

Inspect evergreens for insects and diseases, spray as required. Spray for borers. Continue to weed beds. Fertilize trees and flowering shrubs if they have buds.
Application should be 10-8-4 at a rate of ten (10) pounds per 1,000 square feet. Acid loving plants should be given special attention as called out in "Material Used".

APRIL: WEEKS 1, 2, 3, 4

TURF

Mowing should be continued; begin cutting one and one-half (1 1/2") inches to two (2") inches above grade. Water as required.

TREES, SHRUBS, AND VINES

Flowering plants should be through flowering and ready to be pruned and fertilized, if not already completed. Prune remaining dead wood from trees, shrubs, and vines, retaining natural shape. Continually remove all suckers on base of trees.

MAY: WEEKS 1, 2

TURF

Mowing shall continue once a week. During this period, it is important to note the soil moisture. Grasses may have been actively growing for about two and one-half (2 1/2) months, and need to be watered thoroughly.

TREES, SHRUBS, AND VINES

Inspect evergreens for mites and borers and spray as required. Inspect plants for scale insects and spray as required. Inspect flowering trees for powdery mildew and apply fungicide as required. Apply herbicide to shrub beds as required, using the same materials as in early spring. Weed beds as required. Water established trees at a rate of two (2") inches per week.

MAY: WEEKS 3, 4

TURF

Mow as required. Second application of fertilizer (Microlife Humates 0-0-4) shall be applied at manufacturer's maximum recommended rate. Water thoroughly after applying fertilizer. Mow first; then fertilize. Particular attention shall be directed to the amount of water applied to turf.

TREES, SHRUBS, AND VINES

Continue to check plants for pests and control as required. Water any established plants as needed. Pruning shall cease until Fall. Apply fertilizer to acid loving plants again.

JUNE: WEEKS 1, 2, 3, 4

Mulching trees, shrubs, groundcovers and seasonal color.

NATIVE GRASSES

Native grasses and love grass shall be mowed.

TURF

Mowing shall continue once per week. As the temperature rises, the mower should be raised one-half (1/2") inch to one (1") inch higher to maintain a good thick stand of grass. Inspect lawn for disease and inspect pests; apply fungicide only if necessary. Be alert for brown patch, Bermuda decline and chinch bugs in Bermuda sod. Watch Bermuda for bare spots and underwatered areas.

TREES, SHRUBS, AND VINES

Maintain adequate moisture for newly planted trees, shrubs, and vines. Water any established plants as needed. Do not fertilize any wood plants until cooler weather. Continue to check plants for pests and control as required. Weed beds as required.

JULY: WEEKS 1, 2, 3, 4

TURF

Mow weekly, maintain previous months height. Avoid watering in the middle of the day. Check turf for disease again, especially chinch bugs. Third application of fertilizer (Microlife Hybid 20-0-5) should be applied at manufacturer's maximum recommended rate. Apply recommended controls as necessary.

TREES, SHRUBS, AND VINES

Maintain adequate moisture for newly planted trees, shrubs, and vines. Water any established plants as needed. Do not fertilize any woody plants until cooler weather. Continue to check plants for pests and control as required. Weed beds as required.

AUGUST: WEEKS 1, 2, 3, 4

TURF

Mow weekly. Continue to irrigate as needed to keep turf from being stressed by lack of water. Inspect lawn for diseases. Apply necessary chemicals if needed; use caution.

TREES, SHRUBS, AND VINES

Continue to check trees, shrubs, and vines for adequate moisture around rootballs. No pruning shall be done during this period. Check all trees, shrubs, and vines for possible disease and insects, spray if necessary. Second application of fertilizer should be spread at manufacturer's maximum recommended rate.

SEPTEMBER: WEEKS 1, 2

TURF

Mow weekly. At this time lower mower to one and one-quarter (1 1/4") inches to one and one-half (1 1/2") inches. Irrigate as needed.

TREES, SHRUBS, AND VINES

Maintain adequate moisture for newly planted trees, shrubs, and vines. Water any established plants as needed. Root feed trees again. Acid type fertilizer and iron should be applied to trees, shrubs, and vines.

SEPTEMBER: WEEKS 3, 4

TURF

Mow weekly. Watch turf for diseases, apply chemicals as required.

TREES, SHRUBS, AND VINES

Maintain adequate soil moisture for all trees, shrubs, and vines. Prune only if necessary. Continue to check for any pests or disease, apply chemicals as required.

OCTOBER: WEEKS 1, 2, 3, 4

TURF

Mow weeks 1, 2 and 4. Watering can be reduced at this time. Continue to check for diseases. Fourth application of fertilizer (MicroLife 6-2-4) shall be applied at manufacturer's maximum recommended rate. Mow first; then fertilize. Water thoroughly after applying fertilizer. Turf should be thick and healthy for winter months. Overseed with annual rye grass at the rate of four (4) pounds per 1,000 square feet (only if requested by the Owner).
TREES, SHRUBS, AND VINES

Check trees for proper fertilization. Apply necessary elements, if inadequate. Pruning can be started lightly at this time. Weed beds as required. A two (2") inch layer of mulch shall be added on top of existing mulch.

NOVEMBER: WEEKS 1, 2, 3, 4

TURF

Mow weeks 2 and 4. Water less at this time.

TREES, SHRUBS, AND VINES

Examine plants for pests and spray as required. Do not use pesticides unless necessary. Weed beds as required.

DECEMBER: WEEKS 1, 2, 3, 4

NATIVE GRASSES

Native grasses and love grass shall be mowed.

TURF

Last mowing shall be performed during first 2nd week of month. Rake leaves as required.

TREES, SHRUBS, AND VINES

Remove leaves from beds. Weed beds as required. Check plants for diseases, spray as required.

END OF SECTION 32 94 00

SECTION 32 94 43 - TREE GRATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast metal tree grates.
2. Metal frames and accessories.

1.2 DEFINITIONS

A. ADA: Americans with Disabilities Act.

1.3 REFERENCE STANDARDS

A. General: Use most current standard, unless otherwise indicated by specific date.

B. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A48 - Standard Specification for Grey Iron Castings.
3. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A536 - Standard Specification for Ductile Iron Castings
6. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings.
7. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
8. ASTM E303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.2 - Structural Welding Code - Aluminum.
3. AWS D1.6 - Structural Welding Code - Stainless Steel.

D. California Department of Health Services:

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

E. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual.

2. SSPC SP 10 - Near-White Blast Cleaning.

F. Military Standardization Documents:

1. MIL A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys.
2. MIL PRF-24712A - Coatings, Powder.

1.4 COORDINATION

A. Coordinate Work of this Section with:

1. Placement of frames.
2. Size of cast-in-place curb and pavement openings.
3. Placement of in-ground light fixtures.
4. Plant irrigation systems and controls.

1.5 SUBMITTALS

A. Product Data: Indicate compliance with applicable Reference Standards.

B. Shop Drawings: Indicate details of each type and size of grate, component supports, anchorages, openings, perimeter construction details, and tolerances.

1. Where custom design or layout has been furnished by the Design Professional, submit CAD file, in addition to other Drawings, to indicate compliance with design intent.
2. Where intent of Design Professional cannot be met due to size, material, or casting limitations, clearly indicate exceptions on Submittal documents.

C. Samples: Submit [two] 2 cast metal samples, 12 by 12 inch in size, illustrating finish, color, and texture.

1.6 QUALIFICATIONS

A. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months for employed weld types.

1.7 WARRANTY

A. Provide manufacturer’s standard one-year 1-year warranty on products and assemblies.

1.8 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements of existing trees or obstructions affecting tree grates prior to fabrication. Indicate field measurements provided by General Contractor or other parties on Shop Drawings

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. General: Conform to local code(s) as indicated on Drawings for applicable loads.

1. Except where required by Authority Having Jurisdiction (AHJ), provide tree grates for pedestrian live load only, 100 lbs./sq. ft.

2.2 TREE GRATES

A. Manufacturers:

1. Streetlife; contact Janet Chen @ 484 544 3132
2. Or approved equal.

2.3 SUSTAINABILITY CHARACTERISTICS

A. Material and Resource Characteristics:

1. Recycled Content Materials: Furnish materials with minimum of 80 percent recycled metal content.

B. Indoor Environmental Quality Characteristics:

1. Paints and Coatings: Maximum volatile organic compound content according to product and testing requirements of CA/DHS/EHLB/R-174.

2.4 GRATE MATERIALS

A. Cast Iron: ASTM A48, CL 30 or better.

B. Cast Ductile Iron: ASTM A536; alloy 65-45-12

C. Cast Aluminum: ASTM B26; alloy #535, marine grade.

D. Cast Bronze: ASTM B584 silicone bronze alloy C87500.

2.5 TREE GRATES

A. Size: As indicated on Drawings.

B. Basis of Design Pattern: square by Streetlife (ref. materials schedule for pattern).

C. Number of Sections per Set: As indicated on Drawings.

D. Tree Opening: As indicated on Drawings.

1. Expanded Tree Opening: Fabricate round openings with break-out rings to allow tree growth up to 4-inches.

E. Accessory Openings: Number and locations as indicated on Drawings.

F. Frames:

1. Mild Steel: ASTM A36, raw/unfinished.
2. Welding Materials: AWS D1.1, type as required for materials being welded.
3. Not required.

2.6 FABRICATION

A. Fabricate tree grates to accommodate design loads and to sizes indicated.

B. Fabricate support framing for openings as required. Coordinate locations with fixtures, controls, and penetrations as indicated on Drawings.

C. Fabricate grates to comply with ADA for maximum opening size, offset of surfaces, and slip resistance. Grates shall have a minimum slip resistance (Pendulum Test Value) of 5.5 or better, per ASTM E303.

1. Provide grates with enhanced heel-proof design, with no opening wider than 1/4-inch.

D. Removable Panels: With vandal-resistant fastening hardware, recessed finger lift rings and handles.

2.7 GRATE FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Cast Iron:

1. Baked-on oil finish.

2.8 ACCESSORIES

A. Vandal Resistant Bolts: Stainless steel, 1/4 x 20 fasteners; minimum 2 per casting. Prefabricate frames with fasteners where shown on Shop Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that overall opening sizes and dimensional tolerances are acceptable.

B. Verify that fixtures placed by other trades are completed, and that openings and penetrations are accurately positioned.

C. Verify that planting and irrigation work is complete, including removal of excess soil material and trash from tree grate opening.

3.2 INSTALLATION

A. For cast-in-place frames, furnish to entity responsible for adjacent curbs or pavements.

B. Ensure trees are planted with top of root ball 6 inches below bottom of support framing to mitigate root ball heaving of grate as tree grows.

C. For field-anchored frames, anchor by expansion bolts to prepared openings using anchors of type and number recommended by manufacturer.

D. Ensure that top of frame and tree grate is no greater than 1/8-inch higher or lower than adjacent pavement surfaces.

E. Place tree grates securely in prepared openings, with no warping or slippage.

F. Secure where indicated, or as needed to prevent movement. Allow for maintenance removal.

3.3 TOLERANCES

A. Maximum Space Between Adjacent Sections: 1/4-inch.

B. Maximum Variation from Top Surface Plane of Adjacent Sections: 1/8-inch.

3.4 PROTECTION AND CLEANING

A. Protect completed tree grates until time of Substantial Completion.

B. Clean damaged coatings according to manufacturer recommendations.

C. After frames are installed, but prior to grate installation, keep soil around trees clear from debris, runoff, or anything that will inhibit proper development and growth of the tree.

END OF SECTION 32 94 43

SECTION 33 10 00
WATER DISTRIBUTION SYSTEM CONSTRUCTION

1. DESCRIPTION:

These specifications shall govern the furnishing and placing of water distribution lines, fittings, valves, fire hydrants, and other appurtenances. The pipe and accessories shall be installed in accordance with the requirements of these specifications at the locations and depths indicated on the plans, and shall be of the classes, sizes, and dimensions shown thereon. The installation of pipe shall include all joints, connections to new or existing pipes, and installation of all fittings, valves, fire hydrants, and appurtenances. The specific type materials permitted for this project are indicted on the plans, in the Special Conditions, and/or as specified in the Bid Proposal.

2. MATERIALS:

2.1 4" Through 48" Ductile Iron Pipe Fittings for Ductile Iron Pipe M.S. - 1001

2.1.1 All Ductile Iron Pipe shall be designed in accordance with ANSI Standard A21.50-1976 (AWWA C-150-1976), or the latest revision thereof, Method of Design. Ductile Iron Pipe shall be thickness class 50, pressure rated for 200 PSI in Type II Laying Condition with 2 to 15 feet of cover, unless otherwise indicated on the plans or in the special provisions of the specifications.

2.1.2 Ductile Iron Pipe shall be manufactured in accordance with ANSI Standard A21.50-1976 (AWWA C-151-1976) or the latest revision thereof.

2.1.3 Fittings for Ductile Iron Pipe shall be either Cast Iron or Ductile Iron and shall conform to body thickness and radii of curvature revision thereof.

2.1.4 Pipe and fittings shall be cement mortar lined and seal coated in accordance with ANSI Standard A21.1971 (AWWA C-104-1971), or the latest revision thereof, for standard thickness. The exterior of the pipe shall have a bituminous coating approximately one (1) mil thick.

2.1.5 Pipe and fittings noted on the plans and in the special provisions of the specifications to be supplied with a Polyethylene Lining of 20 mils (0.20") thickness shall be United State Pipe and Foundry Company's Polylined Pipe. The lining shall be suitable for service at operating temperatures up to 180 degrees F. The lining shall be a blend of High-Density and Low-Density Polyethylene Powders complying with ASTM D-1248 compounded with carbon black to provide resistance to ultraviolet rays during storage above ground. To provide uniform fusing of the Polyethylene Powders and proper bonding to the Ductile Iron Pipe, the pipe shall be preheated in a furnace to an adequate temperature.

2.1.6 Pipe and fittings which are to be supplied uncoated and/or unlined or with any special lining or coating will be indicated on the plans and/or covered in special provisions of the specifications.

2.1.7 Joints for Pipe and Fittings:

a. Push-on joints shall be Tyton Joint and shall conform to ANSI Standard A21.11-1976, Section 11-2.3 (AWWA C-111-1976 Section 11-2.3) or the latest revision thereof. All required lubricant shall be included with the pipe and/or fittings.

b. Mechanical joints shall conform to ANSI Standard A21.11-1976 (AWWA C-111-1976) or the latest revision thereof. All required bolts, nuts, glands, and gaskets shall be alloy steel (Corten or US alloy type) and be cathodic to ductile iron and cast iron.

c. Flanged joints for pipe shall conform to ANSI Standard A21.15-1975 (AWWA C-115-1975) or the latest revision thereof. Flanges shall be class 125 drilled and faced in accordance with ANSI Standard B16.1. Required nuts, bolts, and gaskets are to be included with pipe and/or fittings.

2.1.8 Pipe and fittings shall contain no more than 8% lead.

2.2 Poly-Vinyl Chloride Pipe:

2.2.1 Materials for pipe and couplings shall be from clean virginal Type I, Class I, Grade I, PVC according to ASTM D1784 and meeting AWWA C900 Standards for Poly-Vinyl Chloride (PVC) pressure pipe, 4" through 12" for water and to be furnished in cast-iron pipe equivalent outside diameters with rubber-gasketed separate couplings as listed in the Standard.

2.2.2 Pressure Classes of 150 psi and 200 psi shall be furnished.

2.2.3 Pipe shall be furnished in 20' laying lengths.

2.2.4 All fittings for PVC pipe shall be ductile iron.

2.2.5 Plastic pipe shall bear the NSF-pw seal and shall conform to the requirements of ANSI/NSF Standard 61.

2.2.6 Pipe shall comply with applicable American Water Works Association Standards.

2.2.7 Pipe and appurtenances shall be new and shall not have been used for any purpose other than the conveyance of drinking water.

2.3 Copper Tubing:

2.3.1 Materials for copper tubing to be used for underground service shall conform to ASTM Class "A" and Federal Specification WW-T-799, Type "K".

2.3.2 Tubing shall be furnished as follows:

a. 3/4" through 1" - 60' coils.
b. 1-1/4" through 2" - 20' straight length.

2.4 Gate Valves:

2.4.1 Cast iron body conforming to AWWA C500-61 standard.

2.4.2 Double disc type with non-rising stem.

2.4.3 Bell end joints, push-on or mechanical joint for CI & AC.

2.4.4 Two inch square operating nut.

2.4.5 Vertical without bypass for 4-16".

2.4.6 Horizontal with enclosed steel bevel gears and standard size bypass for 20-24".

2.4.7 Two valve operating wrenches shall be delivered to owner prior to start up.

2.4.8 Direction of opening to be specified in special provision. Valves shall be installed in "closed position".

2.5 Tapping Valves:

2.5.1 Tapping valves shall meet all requirements of gate valves listed above except for type of joints.

2.5.2 Inlet joints shall be flanged and drilled for Class 125 (ASA B 16.1 - 1960) and shall have machined projection to mate with the tapping sleeve for alignment purposes.

2.5.3 Outlet shall be either hub-end push-on type, or mechanical joint as specified.

2.5.4 Outside flange shall be drilled (or slotted) to meet standard Mueller (tap) tapping machine Model Nos. CL-1 or CC-25 or CL-25.

2.6 Tapping Sleeve:

2.6.1 Tapping sleeves shall be of the split sleeve type with flange tapping outlet. Flange shall be drilled to match Class 125 (ASA B 16.0 - 1960) and shall have a machined recess to mate with the machined projection on the tapping valve for alignment purposes.

2.6.2 Tapping sleeve bodies shall be of cast iron material with mechanical joints for use on cast iron pipe and mechanical joint ends for use on asbestos-cement pipe, except as noted below.

2.6.3 Welded steel tapping sleeve bodies may be used in lieu of cast iron for the following sizes with the following specifications:

a. Approved sizes shall range from 6" x 4" upward, but no "size-on-size" sleeve will be permitted (i.e. 4" x 4", 6" x 6", etc.). To accomplish size-on-size connections, the next smaller tap may be made and an LEB increaser used. Where fire service from 6" main is approved, a cast iron split sleeve only will

be permitted.

b. Body shall be of heavy welded steel construction.

c. Top half of body shall be grooved to permanently retain a neoprene O-ring seal against the O.D. of the pipe.

d. Bolts and nuts shall conform with the latest published AWWA Standard C500, Section 9, and shall be coated with a 100% vinyl resin (or be of corrosion resistant material).

e. Finish on the tapping sleeve shall be 100% vinyl resin on all surfaces with a minimum thickness of ten mils.

f. Finish seal from backfill shall be made by completely encasing the tapping sleeve with sheet vinyl of eight mil thickness.

g. Steel tapping sleeve shall be Smith Blair No. 622 or an approved equal.

2.7 Valve Boxes:

2.7.1 All buried valves to be provided with valve box.

2.7.2 Standard CI screw adjustable height for required bury, 5" minimum diameter.

2.7.3 Cover marked "Water".

2.7.4 Minimum thickness of 3/16" at any point.

2.7.5 Coated with asphaltic paint inside and out.

2.8 Flushing Valves and Fire Hydrants:

Fire hydrants shall be compression type traffic model cast iron body, fully bronze mounted, suitable for working pressure of 150 psi, and shall conform to the provisions of the latest revision of AWWA C502 specification. Each hydrant shall be factory tested to a hydrostatic pressure of 300 psi with valve in both the open and closed positions. The direction of opening nut shall be counter-clockwise and shall be cast on the head of the hydrant. Hose nozzles shall be bronze or non-corrosive metal and threads shall be national standard. The main valve opening shall be either five and one-fourth (5-1/4) inches in diameter or six and one-fourth (6-1/4) inches in diameter as shown on the plans. Hydrants shall have mechanical joint shoes for six (6) inch or eight (8) inch mains as shown on the plans, one four and one-half (4-1/2) inch steamer connection, and two and one-half (2-1/2) hose connections. All nozzle caps shall be provided with gaskets. Bury length shall be three and one-half (3-1/2) feet unless otherwise noted on the plans. Hydrants shall be provided with "dry top" which prevents stem threads from contacting water, and "break-off" type barrel and stem.

Special nozzles may apply if so stated in the Special Conditions. Hydrants shall be painted with shop coating in accordance with AWWA C502 specification. Final coats of paint will be applied by Owner. Fire hydrants shall be Mueller Improved, or approved

equal.

2.9 2-Inch Blowoff Valve Assembly:

All two inch (2") blowoff valve assembly shall have 2-1/8 inch valve opening and shall have one full 2-1/2 inch hose outlet. Bottom connection shall be 2-inch standard thread or 2-inch bell bottom as specified on the plans.

2.10 Water Meters: (For Individual Houses Only)

All water meters shall be standard make 5/8" x 3/4", AWWA approved specifications for measuring water for domestic use, furnished complete with couplings, with round reading register in U.S. gallons. Make and type of meter shall meet the approval of the Engineer.

2.11 Water Meter Boxes:

All meter boxes to be of concrete construction of adequate size for installation of 5/8" x 3/4" standard AWWA water meter, with easy opening reading lid, being lockable.

3. CONSTRUCTION METHODS:

3.1 Location of Water Lines:

Distance of water lines to property lines shall be indicated on the plans. Parallel water and sewer lines shall be spaced not less than nine (9) feet apart horizontally unless water tight sewer joints are provided as indicated on sewer detail plan sheet.

All pipe shall be installed in accordance with the manufacturer=s instructions and the details.

3.2 Excavation:

3.2.1 All excavations are to be by the open-trench method, unless the inspector orders that certain sections of the mains are to be laid in tunnels or bored.

3.2.2 The minimum width of the bottom of the trench shall be such that there will be six inches space on each side between the pipe and the walls of the trench. The width of the trench at the surface is not to be less than at the bottom.

3.2.3 When excavating machinery is being used, the same shall cut the trench to a grade slightly higher than the bury indicated by the proposal and the trench shall then be fine graded.

3.2.4 The trench must be opened and excavated to the finished grade at all times for a distance of at least 50 feet in advance of the last made-up joint. Water mains into which the mains under construction are to be connected must be definitely located well in advance of such connection to allow for possible adjustment of alignment and/or grade.

3.2.5 Bell holes must be excavated in advance of placing the pipe. Materials used shall be placed at locations so as not to interfere unnecessarily with the use of the

streets by the public, and not more than two street intersections shall be closed at any time. The street surface along the line of the trench must be kept free of surplus spoil. Any amount of trench left open in excess of that required to facilitate hydrostatic testing may be ordered closed by the inspector or Engineer.

3.2.6 The expense of restoring the original condition of improved property in connection with grass, shrubs, or any other improvements must be borne by the Contractor. All trees adjacent to the trench must be protected and the trees on public or private property must not be cut unless permission, in writing, is granted.

3.3 Rock Excavations:

No rock is anticipated and no extra compensation will be allowed for rock excavation.

3.4 Crossing State Highways and Railroads:

When water lines cross highways, railroads, or town streets under the jurisdiction of the State Highway Commission or other public body or corporation, the Engineer shall secure permission from the controlling authority before installing such lines. A copy of this written permission must be filed with Owner before Contractor works on the right-of-way of such State roads or streets. The Contractor will be required to furnish a release from said controlling authority before final acceptance of the work.

3.5 Pipe Crossing Trenches:

Where any pipe crosses a trench, such as sewer pipe, water or gas pipe having an exposed joint in the trench, it must be supported entirely at the Contractor's expense with a reinforced concrete beam constructed in the following manner: A trench under said cross pipe shall be opened up to a point varying from two (2) to six (6) feet back from the sides of the main trench, as the Engineer may direct so that a timber box may be placed around the pipe and supported by two (2) struts, one on each side of the trench, and resting on a plank across the bottom of the trench, underneath the water line and of such dimensions as is necessary, in the opinion of the Engineer to properly support the ends of the beam and pipe which it carries. The width of this box shall be twice and the depth shall be three times the outside diameter of the pipe supported, and the top shall be placed level with the top of the pipe. The box shall then be filled with 3,000 psi concrete with a sufficient number of bars of reinforcing steel placed one (1) inch above bottom of box extending the entire length thereof, to provide an area of steel equal to one percent of the sectional area of concrete in the beams. The timber used as forms and struts must be left in the trench. Such concrete will be paid for at the price bid for 3,000 psi concrete.

Should it become necessary to change the position of such pipe, conduit, or structure, the Engineer shall at once be notified of the locality and circumstances and shall thereupon give directions as to what shall be done, and the Contractor shall conform thereto, and shall be paid (upon the estimate of the Engineer) for materials furnished and for the labor performed upon such change in so far as it may be additional to that contemplated. The Contractor shall be responsible for injuries to persons and property for all damage to any pipe, conduit, sewer, or other structure injuriously affected by the work and the Owner shall not be liable therefor.

3.6 Tunnel Construction:

3.6.1 When a water or sewer main crosses a paved roadway having a concrete base, the main shall be laid in a tunnel whenever, in the opinion of the Engineer, the cut is sufficient for tunneling. Openings for removing the excavated material and for placing the pipe shall be made at the locations designated by the Engineer. The tunnel must be sheeted solid on both sides and top and each side supported on a piece of lumber laid longitudinally on the bottom of the trench, but this support must not be wide enough so as to pass under the pipe.

The tunnel shall not be backfilled until after the section of the mains passing through the tunnel has been subjected to a pressure test and has received the approval of the inspector. When backfilling a tunnel, the space between the sheeting and the pipe shall be rammed, in an approved manner, with earth, gravel, or concrete. If concrete is used, 3,000 psi concrete shall be used.

3.6.2 Should the surface over a tunnel settle during the maintenance period of the water main contract, the Contractor or his sureties must pay for the necessary repairs. Should the street settle prior to the time that the final estimate has been paid, then same may be retained until repairs have been made.

3.6.3 Should the Contractor be instructed to lay the mains in tunnels under trees, sidewalks, driveways, and other such surface or subsurface obstructions, there will be compensation for this work or for furnishing and placing the specified sheeting and bracing, according to the appropriate proposal items.

3.7 Sheeting and Bracing Timber:

Where necessary in the Engineer's opinion, the sides of the trench or other excavation shall be braced and rendered secure to the satisfaction of the Engineer.

In sewer trenches and other excavations having vertical sides, sheeting and bracing necessary to support the sides of the excavation in a vertical plane shall be installed.
After the excavation has been backfilled and water tamped, steel or other sheeting may be pulled, otherwise sheeting and bracing, once installed, may not be removed without the consent of the Engineer.

3.8 Backfilling Trenches:

Trenches shall be backfilled as follows:

3.8.1 Normal: Selected material shall be deposited in four inch layers and hand tamped between the sides of the trench and the pipe and over the pipe for at least six (6) inches above the top of the pipe.

3.8.2 Under Pavement: For trench through existing or future asphaltic concrete, concrete, asphalt-topped concrete, flexible base with asphalt topping, shell or gravel surfaces, either public or private roads or streets, place sand-cement backfill above the bedding and initial backfill to bottom of pavement or base. Cement stabilized backfill will be paid extra at unit price specified in the Bid Proposal.

3.9 Surplus Earth:

Any surplus excavated material shall be disposed of on site as directed by the Engineer. If the Engineer notifies the Contractor that the Owner does not have use for this material, it shall become the property of the Contractor to dispose of as he wishes without injury to the Owner or any individual.

3.10 Street Surfaces:

In all streets, the surface of the trenches after being refilled, dried, and settled, shall be finished in the most workmanlike manner without needless delay and shall in every respect be equal in quality, character, material, and workmanship to the street improvements existing over the line of the trench immediately prior to making the excavation. The expense of restoring the streets must be included in the price bid per linear foot for mains, except as otherwise provided herein. All concrete paving, road gravel, and road shell ordered placed on streets will be paid for at the unit price bid.

On gravel, shell, and asphalt surfaced streets, the trench shall be filled as otherwise specified up to within eight (8) inches of the surface of the street. The trench shall then be filled with gravel or shell, as ordered by the Engineer, to a point approximately one (1) inch higher than the street level. After all other work is completed and before the job is finally accepted, the Contractor shall go back and place such additional gravel or shell as is ordered by the Engineer. Road gravel or stabilized shell shall be paid extra for at the unit price bid in the proposed schedule.

On concrete streets the trenches shall be filled as otherwise specified within six (6) inches of the surface of the street, and then filled with road gravel or shell to a point approximately one (1) inch higher than the street level. After all other work is completed, the Contractor shall go back and remove sufficient shell and install six (6) inches of concrete as ordered by the Engineer. The concrete used shall be paid for at the unit price bid in the proposed schedule.

On asphalt surfaced streets, the gravel or shell base shall be placed as stated above. At such time as directed by the Engineer, the gravel or shell base shall be leveled smooth approximately one (1) inch below the existing asphalt surface. The new asphalt pavement shall then be placed and rolled or tamped to a smooth and even surface.

3.11 Crossings to be Kept Open:

At such street crossings and other intermediate points as may be designated by the Engineer, the trenches shall be bridged in such proper and secure manner as to prevent any serious interruption of travel upon the roadway and sidewalks, the cost thereof to be borne by the Contractor.

3.12 Clean-Up:

Contractor's equipment, surplus material and surplus earth shall be removed from the job following the final test of mains and all street surfaces replaced before the final estimate will be approved.

3.13 Laying Pipe:

In general, the bottom of the trench shall be shaped to give full support to the lower quarter of each pipe. If the foundation is rock or other hard material, a bed of sand or suitable earth shall be placed upon the subgrade and well compacted. The thickness of the bed shall not be less than two (2) inches nor more than six (6) inches.

If the foundation is of such material or if conditions are such that the pipe cannot be otherwise properly supported, or if the load on the pipe so requires, a concrete cradle as hereinafter specified shall be provided. In all cases, water shall be kept out of the trench until the masonry or jointing material has sufficiently hardened. The pipe shall be laid to grade shown on the plans or as directed by the Engineer. Each pipe shall be inspected for defects prior to being lowered into the trench and shall be carefully cleaned in both bell and spigot. Pipe laying shall proceed up-grade with spigot ends pointing in direction of flow. Pipes shall be laid so that each pipe shall rest upon the full length of its barrel with depressions excavated to accommodate bells. Any defective pipe laid or any pipe which has had its grade of joint disturbed after laying shall be taken up and replaced.
Before jointing, the inside of the bells and outside of the spigots shall be dry and clean. The joint shall be made as recommended by the manufacturer of the joint material. Water shall not be allowed in the trenches while the pipes are being laid. The Contractor shall not open up more trench than the available pumping facilities are able to de-water, to the satisfaction of the Engineer. Bells shall be entirely free of water when joints are made, regardless of the type of joint, and no water shall be allowed to rise over the joint until it has set.

3.14 House Connections:

House connections to main pipe shall be made by tapping the main and installed corporation cock of the size designated. The corporation cock shall be screwed securely into position. The copper service, polyethylene or butylene pipe shall be connected to the corporation cock and laid in accordance with the specifications contained herein for laying pipe.

3.15 Installing Water Meters and Meter Boxes:

Water Meters: The ground shall be excavated to such depth that the top of the box is flush with normal ground level. The tail piece of the meter shall be inserted into the service lines as near to the curb cock as possible, or directly into the curb cock. The meter shall then be set in such position that the bottom of the meter is at lest two (2) inches above ground. The house side of the meter shall then be connected to the service line running to the house. It is essential that the meters shall be set plumb and in line with the service line and all connections made in a neat, workmanlike manner.

Meter Boxes: The meter box shall be set on firm ground so that the top of the meter box is flush with the ground surface, and the box is level and plumb. Ground shall be carefully backfilled and tamped around the meter box so as to leave a neat appearance.

3.16 Setting Fire Hydrants:

Fire hydrants shall be set where shown on the plans or ordered by the Engineer.

Excavate underneath the drain outlet of each fire hydrant a space twelve (12) inches square and six (6) inches deep and fill with gravel. Place the gravel up around bottom of the flushing hydrant not less than three (3) inches above the drain outlet. Not less than two (2) cubic feet of gravel shall be placed around each flushing hydrant. The gravel shall be carefully covered with a layer of one ply roofing paper before trench around the hydrant is refilled. All hydrants shall be carefully blocked and placed to prevent expansion of stubline from water pressure. See plan sheet for blocking details.

3.17 Flushing and Sterilizations:

3.17.1 All water lines shall be carefully cleaned on the inside before installation and as the lines are installed, there shall be placed in the lines one can (3-3/4#) of Perchloron or HTH, or equal, for each 2,000 lineal feet of four (4) inch, six (6) inch, and eight (8) inch lines, or 6,000 lineal feet of two (2) inch lines. The Contractor shall test all lines for proper sterilization in the presence of Engineer and deliver or have results sent to office of Engineer. Chlorine gas shall be acceptable for sterilization.

3.17.2 For this project, all mains shall be sterilized with a minimum chlorine contact time of 24 hours.

3.17.3 All lines shall be flushed at a minimum velocity of 3 feet per second in the line at all blow-offs and dead-ends.

3.17.4 After flushing and before placing mains in service, samples shall be collected for bacteriological analysis to check the efficiency of the disinfection procedure, which shall be repeated if contamination persists. Tests shall be collected at a rate of one sample per 1,000 feet of line laid, at sampling points approved by the Engineer.

3.17.5 All water lines and appurtenances shall be disinfected in conformance with AWWA C-651 standards prior to being placed into service.

3.18 Thrust Blocking:

All water lines shall be thrust blocked at bends, tees, caps, plugs, and fire hydrants to prevent movement of lines under pressure. The blocking shall be 3,000 psi concrete and shall completely fill the space between the solid ground and the fitting to be anchored in such manner that the pipe and the fitting joints will be accessible for repairs. Thrust blocking shall be installed at all points designated by the Engineer with no extra payment.

3.19 Testing of Water Mains:

a. After the pipe has been laid and partially backfilled, excepting at joints, all newly laid pipe shall, unless otherwise specified, be subjected to hydrostatic pressure 150 pounds and not less than 150% of the maximum anticipated sustained operating pressure.

b. Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. The Contractor will furnish, install, and operate, at his expense, the

necessary connections, pump, meter, and gauges. Evidence of the condition of the pump must be provided to the Engineer prior to testing.

c. Each section of pipe shall be tested just prior to chlorination. Before applying for the specified pressure test, all air shall be expelled from the pipe. Should the taps at points of highest elevation be required to accomplish this, then same will be installed by, and at the expense of, the Contractor.

d. All joints showing visible leaks discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the Engineer.

e. All pressure tests shall be performed using a minimum pressure of 150 psi at the highest point in the line. The time of the testing shall be a minimum of 4 hours.

f. The allowable leakage for P.V.C. and D.I. pipe shall be computed in accordance with AWWA C-605 (current) and shall not exceed the gallon per hour per 1,000 feet rate listed in the table below:

Pipe Size (Inches)	Allowable Leakage
2	0.16
4	0.33
6	0.49
8	0.66
10	0.82
12	0.99
16	1.32

For all diameters, the allowable leakage, Q, shall not exceed:

Q = L * D * (P □ 0.5) /148,000
for L = length of pipe per test in feet, D = nominal diameter of pipe in inches, and P = test pressure (150 psi minimum).

g. Where practicable, pipe lines shall be tested in lengths between line-valves or plugs of no more than 1,500 feet.

h. If the leakage exceed the allowable rate, repairs must be made and the test must be redone until each segment passes the test.

i. All visible leaks at exposed joints, and all leaks evident on the surface where joints are covered, shall be repaired and leakage minimized, regardless of total leakage as shown by test.

j. All pipe, fittings, and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.

k. Lines which fail to meet the tests shall be repaired and restored as necessary, until test requirements are complied with.

4. METHOD OF MEASUREMENT

4.1 Pipe:

Water pipe shall be measured by the linear foot of each size and class of pipe complete in place accordance with these specifications. Such measurement shall be made along the central axis through all valves and fittings from end of line to end of line. Where spurs, braces, or connections to existing pipe lines are involved, measurement of the spur or connecting pipe shall be made from the point of intersection of the central axis.

4.2 Wet Connections:

Wet connections shall be measured separately according to size main involved.

4.3 Valves:

Gate valves, air valves, and check valves shall be measured as each individual valve of each size, completely installed with valve box and concrete bedding as shown on the plans.

4.4 Fire Hydrants:

Fire hydrants shall be measured as each individual hydrant of the sizes shown on the proposal, completely installed in accordance with the plans.

4.5 Fittings:

Fittings shall be measured by the ton (2,000 pounds) as computed from theoretical weights listed in AWWA C110-64 (ASA A21.10) specification.

END OF SECTION

SECTION 33 33 13
SANITARY SEWER SYSTEM MATERIALS AND CONSTRUCTION

1. GENERAL:

This item is a general specification which applies to the furnishing of all plant, labor, equipment, appliances, and materials in performing all operations in connection with installing sanitary sewer lines and appurtenances with dimension, strength, and location in accordance with the plans and these specifications.

2. MATERIALS:

(Type materials permitted for this project are specified on the Plans, Special Conditions, and/or Bid Proposal.)

2.1 Ductile Iron Pipe:

2.1.1 Conformance to USA Standard A 21.51 and A 21.52.

2.1.2 Joints shall be Mechanical Joints (Type III); or boltless gasket similar to those known as "Bell Tite", "Tyton", or "Fastite" or equal.

2.2 Polyvinyl Chloride Pipe:

2.2.1 Polyvinyl Chloride Gravity Sewer Pipe and fittings shall meet the requirements of: ASTM Specification D-3034 (SDR 26), type PSM Polyvinyl Chloride (PVC) Sewer Pipe and fittings. Gaskets meet the requirements of ASTM F744, Fluid-Tite or approved equal.

2.2.2 All pipe and fittings shall be made from PVC components as defined and described in ASTM D-1784 for Rigid Poly (Vinyl Chloride), compounds and chlorinated poly (Vinyl Chloride) compounds.

2.2.3 Pipe and fittings shall be installed in accordance with ASTM D-2321. Only Class I, I, III, and IV embedment materials will be considered suitable.

2.2.4 The Contractor shall submit to the Engineer for approval a complete set of specifications and manufacturer installation recommendation prior to shipment or installation of these materials.

2.3 Force Mains:

2.3.1 Ductile Iron - Same specification as for water mains.

2.3.2 Polyvinyl Chloride - Same specification as for water mains.

2.4 Manholes:

Construction materials to be used in manholes may be of one of three different types, as approved by the Engineer or as specified in the Special Conditions, Bid Proposal or plans. These types are:

a. Fiberglass Manhole (if allowed for project - see construction notes.)

b. Precast Concrete Manhole

c. Monolithic - Cast-in-Place Concrete

Specific instructions on each type manhole as follows:

2.4.1 Fiberglass

Materials:

a. Manhole: Manufactured reinforced fiberglass plastic as manufactured by Owens/Corning; ARMCO or approved equal.

b. Cast Iron: ASTM A-48, Class No. 20, cast iron. Make cast iron manhole frames and covers to dimensions shown on detail drawing. Casting free from sand or blowholes and other defects. Holes in cover to be free from plugs and burrs. Machine bearing surfaces of manhole frames and covers to obtain even bearing. Cast wording "Sanitary Sewer" or "Storm Sewer", as applicable, on covers. Use Vulcan Number S.VM 19 (Mod - 32" cover) for sanitary sewers or approved equal.

c. Brick: ASTM C-32, Grade NA, except that not more than 16 percent (by weight) maximum individual brick absorption permitted when submerged in water for 24 hours. It must be thoroughly dry prior to placing in water. Use only first quality, solid, hard-burned, uniformly shaped bricks. Make bricks, if used, homogeneous and uniformly burned.

d. Sewer Pipe and Fittings: Same as pipe specified for sewer.

e. Mortar: ASTM C-270, Type S (A-2) using Portland Cement.

f. Aggregate for Mortar: ASTM C-144.

g. Concrete: See Concrete Specifications.

h. Reinforcing Steel: See Steel Specifications.

Construction Methods:

a. Construct manholes on concrete foundation of shape and size indicated for type manhole required. Unless otherwise indicated on the plans, use standard manhole. Make foundation minimum of 8 0inches in thickness, below the bottom of the sewer pipe O.D., except if manhole is over 12 feet deep, make foundation 12 inches thick below the bottom of the sewer pipe O.D.

b. Cut reinforced fiberglass manhole base to accommodate size sewer pipe as indicated on the plans. Maximum tolerance for cut out is 1/2 inch greater than required opening. Base shall be embedded in concrete foundation to a

minimum depth of 6 inches. Place base and foundation as soon as practicable after sewer line is completed through manhole location. To get proper seal where manhole cut out fits over pipe, fresh concrete which is monolithic with slab concrete must be used as shown on outside of manhole. Manholes will be rejected if this seal is not made when the slab is poured and manhole is replaced. Grout with a cold joint between grout and concrete slab is not acceptable.

c. Where main sewer (lowest line) passes straight through manhole or degree of deflection of main sewer is less than five degrees, and no other line or stub-out is shown entering manhole below center line of main sewer, lay sewer continuously through manhole. After manhole walls have been completed, break out and remove top half of barrel of sewer pipe that was previously laid through manhole. Use concrete with 1 inch mortar topping and construct invert as shown.

d. Where main sewer (lowest line) alignment deflects greater than five degrees at manhole or where another sewer or stub-out enters at or below center line of main sewer, terminate main sewer pipe laying in such a manner that ends of pipe protrude inside of manhole. Construct invert with concrete and top with 1 inch of mortar. Shape invert for smooth flow across floor of manhole and slope side as shown to obtain proper contour.

e. Install stub-outs, where shown, to line and grade. Use one full joint of pipe, of size indicated, for stub-out. Seal stub-out with plug. Install plug in such manner as to prevent seepage or leakage through stub-outs. Installation of plug shall be such that it may easily be removed in the future without damaging bell or groove end of stub-out.

f. Where sewer pipe for drop connection enters manhole at other than bottom cut out, a saddle type connection to manhole for pipe size will be provided as shown. Connections depending upon grout for sealing will not be allowed.

g. Manholes shall be installed as one basic unit. Contractor is responsible for verifying correct manhole depth before construction. Initially, manhole tops shall not be less than 6 inches nor greater than 18 inches from final grade. If manholes are relocated in field because of unforeseen conflicts, Contractor is responsible for correct depth of manhole. Manhole tops shall be set as follows:

(1) Developed Areas: Set manhole tops 3" higher than existing elevation of natural ground or other final grade when specified by Engineer.

(2) Undeveloped Areas: Set manhole tops flush with paved surfaces and 1" higher than shoulder and/or proposed final grade elevations in easements or other unpaved areas. Where manholes are located in bottom of ditches either set manhole top, Vulcan Foundry VM-17, or equal Neenah Casting flush with ditch bottom and seal with solid cover, or set 12-inches above ditch bottom and reshape ditch around manhole. Engineer will

specify grade for tops of all manholes.

h. Where drop connections into manholes are required, construct inside drops of 4-inch pipe for six and eight inch sewer lines, and inside drop of 6-inch pipe for ten through fifteen inch diameter sewers. Inside drop connections shall consist of saddle connection with two feet of pipe stub, tee faced vertically down inside manhole connected to stub, riser pipe, and 90 degree elbow at base of stack. Outside stack shall consist of saddle connection on manhole with two foot stub of pipe, tee in sewer line faced vertically down, riser stack, 90 degree elbow at base of stack and joint of pipe into manhole.

   Construct drop connection at time manhole is constructed, being certain to grout bottom manhole connection of drop in same manner prescribed for main sewer. If sewer is not to be immediately connected into drop connections, plug drop in same manner as plugged stub-outs.

i. Backfill around manholes and drop connections immediately after mortar and concrete have set. Place backfill around manhole evenly in 12-inch layers and in such manner that no torque is applied to the manhole.

j. Where proposed sewer line connects to an existing manhole at or near manhole invert, reshape invert of existing manhole so that no turbulence is created in manhole as a result of the connection.

2.4.2 Precast Concrete:

Materials:

a. Manhole: Manufactured by concrete plant with mesh reinforcing in 12", 24", or 36" rings.

b. Cast Iron: Rings and covers shall be in accordance with ASTM A-48, Class No. 20, cast iron. Castings will carry wording "Sanitary Sewer" on covers. Use Neenah or approved equal.

c. Brick: Same as Fiberglass above.

d. Sewer and Pipe Fittings: Same as pipe specified for sewer.

e. Mortar: ASTM C-270, Type S (A-2) using Portland Cement.

f. Aggregate for Mortar: ASTM C-144.

g. Concrete: See Concrete Specifications.

h. Joint Gasket: Joints between adjacent precast section shall be rubber gasket in accordance with manufacturer's requirements. All joints to be sealed water-tight.

2.4.3 Construction Methods: Construction using precast concrete manholes will follow the general procedures as shown under the fiberglass manholes. All

precast concrete manholes shall be constructed in accordance with the detail shown on the plans.

2.5 Monolithic Cast-in-Place Concrete Manholes

2.5.1 Materials:

a. Cast Iron: Same as fiberglass or precast concrete.

b. Sewer Pipe and Fittings: Same as specified for sewer.

c. Mortar: ASTM C-270, Type A (A-2) using Portland Cement.

d. Aggregate for Mortar: ASTM C-144.

e. Concrete: See Concrete Specifications.

2.5.2 Construction Methods:

Construction using Monolithic Cast-in-Place concrete manholes will follow the general procedures as shown under the Fiberglass Manhole. All Monolithic Cast-in-Place Concrete Manholes shall be constructed in accordance with the detail shown on the plans.

2.6 Cleanout Structures:

The Contractor shall construct cleanouts where shown on the plans and as specified. These shall consist of a 6-inch riser pipe laid on an angle on undisturbed natural ground. All backfill around and above the pipe shall be machine tamped in layers not exceeding 3 inches in depth so that no settlement shall occur after the cleanout is constructed. The base of the cleanout shall be laid in Class A concrete, and its size, shall be not less than that shown on the plans. Other construction details casting shall conform to the cleanout detail shown on the plans.

2.7 Connections:

Drop connections shall be constructed in accordance with plans and these specifications for materials and construction. The connection shall include the indicated fittings and necessary quantity of Class A concrete.

Service outlets shall consist of a standard wye and 45 degree bend and necessary vitrified clay sewer pipe to reach the property line, or as shown on the plans, plugged at the end and sealed with approved hot-poured joint compound. If required by the Engineer, the Contractor shall raise the lateral by means of a stack or steeper grade at the main. Stacks shall be installed in separate excavations, outside the trench wall of the sewer main. The wye, bend and lateral pipe shall be encased in Class A concrete of four inch minimum thickness outside the pipe. At the time of construction, the Engineer will designate the locations of the service outlets and the depth to the top of the lateral pipe, if depth is not indicated on the plans. The minimum depth of cover over the end of the lateral pipe shall be four feet.

2.8 Cleanout Covers:

Cleanout covers shall be of the best quality gray cast iron meeting the requirements of Federal Specification QQ-I-652. Unless otherwise specified, the cover shall be free from perforations and shall conform to the cleanout detail in the drawings.

3. CONSTRUCTION METHOD:

3.1 Location of Sewer Lines: Location of sewer lines with respect to property lines will be indicated on the plans. Parallel water and sewer lines shall be spaced not less than nine feet apart horizontally unless water tight sewer joints are provided as indicated on sewer detail plan sheet.

3.2 Excavation: Except as otherwise specified or shown on the plans, all sewers shall be constructed in open cut trenches with vertical sides. Where machines other than ladder type trenching machines are used, excavated material composed of large chunks and clods shall not be used for backfilling and such material shall be disposed of by the Contractor and other suitable material for backfill shall be provided without additional expense to the Owner.

Trenches for pipe sewers smaller than 30-inch shall have a width below the top of the pipe bell or other joint of not less than the outside diameter of the pipe plus 12 inches and not more than the outside diameter of the pipe plus 18 inches. Trenches for pipe sewers 30 inches and larger shall have a width below the top of the pipe plus 16 inches and shall be wide enough to permit making up the joints but shall not be wider than the outside diameter of the pipe plus 24 inches.

No excavated material shall be deposited on the gravel, shell, asphalt, concrete, or other paved area of any roadway or sidewalk, or on any lawn, garden, or shrubbery, and such material shall be handled in such a manner as not to obstruct drainage. Where necessary for compliance with this provision, the material shall be hauled.

Where necessary in the Engineer's opinion, the sides of the trench or other excavation shall be braced and rendered secure to the satisfaction of the Engineer.

In sewer trenches and other excavations having vertical sides, sheeting and bracing necessary to support the sides of the excavation in a vertical plane shall be installed.

After the excavation has been backfilled, compacted, or water tamped, steel or other sheeting may be pulled, otherwise sheeting and bracing, once installed may not be removed without the consent of the Engineer.

3.3 Rock Excavation: No rock is anticipated and no extra compensation will be allowed for rock excavation.

3.4 Crossing State Highways ad Railroads: When sewer lines cross highways, railroads, or streets under the jurisdiction of the State Highway Commission, or other public body or corporation, the Owner will secure permission from the controlling authority before doing any work on the right-of-way of such roads or streets. A written release must be given by the controlling authority before final acceptance of the work.

3.5 Pipe Crossing Trenches: Where any pipe crosses a trench, such as sewer pipe, water or gas pipe, having an exposed joint that will not safely span the trench without danger of breaking, it must be supported with a reinforced concrete beam constructed in the following manner: A trench under said cross pipe shall be opened up to a point varying from two (2) to six (6) feet back from the sides of the main trench as the Engineer may direct, so that a timber box may be placed around the pipe and supported by two (2) struts, one on each side of the trench, and resting on a plank across the bottom on trench, underneath the line and of such dimensions as is necessary, to properly support the ends of the beam and pipe which it carries. The width of this box shall be twice and the depth, not to exceed 12", shall be three times the outside diameter of the pipe supported. The box shall then be filled with Class "A" concrete with a sufficient number of bars of reinforcing steel placed one (1) inch above bottom of box extending the entire length thereof, to provide an area of steel equal to one percent of the sectional area of concrete in the beams. The timber used as forms and struts must be left in the trench.

Should it become necessary to change the position of such pipe, conduit or structure, the Engineer shall be notified at once of the locality and circumstances and shall thereupon give directions as to what shall be done, and the Contractor shall conform thereto, and shall be paid (upon the estimate of the Engineer) for materials furnished and for the labor performed upon such change, insofar as it may be additional to that contemplated. The Contractor shall be responsible for injuries to persons and property, for all damage to any pipe, conduit, sewer, or other structure injuriously affected by the work, and the Owner shall not be liable thereof.

3.6 Tunnel Construction

3.6.1 When a water or sewer main crosses a paved roadway having a concrete base, the main shall be laid in a tunnel whenever, in the opinion of the Engineer, the cut is sufficient for tunneling. Openings for removing the excavated material and for placing the pipe shall be made at the locations designated by the Engineer. The tunnel must be sheeted solid on both sides and top and each side supported on a piece of lumber laid longitudinally on the bottom of the trench, but this support must not be wide enough so as to pass under the pipe. When backfilling a tunnel, the space between the sheeting and the pipe shall be rammed, in an approved manner, with earth, gravel or concrete. If concrete is used, 3000 psi concrete shall be used and the unit bid price for such material will be paid. Should gravel be specified, the Owner will pay twice the price bid for gravel as placed on the street and lumber will be paid for at its bid price.

3.6.2 Should the surface over a tunnel settle during the maintenance period of the water or sewer main contract, the Contractor or his sureties must pay for the necessary repairs. Should the street settle prior to the time that the final estimate has been paid, then same may be retained until repairs have been made.

3.6.3 Should the Contractor be instructed to lay the mains in tunnels under trees, sidewalks, driveways and other such surface or subsurface obstructions, there will not be any additional compensation for this work or for furnishing and placing specified sheeting and bracing.

3.7 Backfilling Trenches: Trenches shall be backfilled as follows:

3.7.1 Normal: Selected material shall be deposited in 6" layers and hand tamped between the sides of the trench and the pipe and over the pipe for at least 6" above the top of the pipe and compacted to 90% density the full depth of the trench where water is available and water settlement of earth backfill is permitted, water shall be applied in a manner which will provide effective settlement of the backfill with a minimum amount of water. In no case shall the trenches be permitted to overflow or water be wasted. Settlement by water puddling shall not be done until after trench has been backfilled to or above the ground surface. Water shall be introduced into the bottom of the trench through a long pipe nozzle, so that disturbance of any tamped material below will be held to an absolute minimum. Backfill material to compensate for settlement below surface grade shall be added as necessary and settled during puddling operations.

3.7.2 Under Pavement: For trench through existing or future asphaltic concrete, concrete, asphalt-topped concrete, flexible base with asphalt topping, shell or gravel surfaces, either public or private roads or streets, place sand-cement backfill in pipe zone to bottom of pavement or base. Cement stabilized backfill will be paid at unit price specified in the Bid Proposal.

3.7.3 Backfill Settlement: The Contractor shall be responsible for all settlement of backfill which may occur within a period of one year after the date of final completion of the contract under which the backfilling work was performed. The Contractor shall make, or cause to be made, all necessary backfill replacements and repairs or replacements appurtenant thereto, within 30 days after notice by the Engineer or Owner.

3.8 Surplus Earth: Any surplus excavated material shall be disposed of onsite as directed by the Engineer. If the Engineer notifies the Contractor that the Owner does not have use for this material, it shall become the property of the Contractor to dispose of as he wishes without injury to the Owner or any individual.

3.9 Street Surfaces: In all streets, the surface of the trenches after being refilled, dried, and settled, shall be finished in the most workmanlike manner without needless delay and shall in every respect be equal in quality, character, material, and workmanship to the street improvements existing over the line of the trench immediately prior to making the excavation. The expense of restoring the streets must be included in the price bid per linear foot for mains, except as otherwise provided herein. All concrete or asphaltic cement paving ordered placed on streets will be paid for at the unit price bid.

On gravel, shell, and asphalt surfaced streets, the trench shall be filled as otherwise specified up to within 4 inches of the surface of the street. The trench shall then be filled with gravel or shell, as ordered by the Engineer, to a point approximately 1 inch higher than the street level. After all work is completed and before the job is finally accepted, the Contractor shall go back and place such additional gravel or shell as is ordered by the Engineer. Gravel or shell shall be paid for at the units prescribed in the proposed scheduling.

On concrete streets the trenches shall be filled as otherwise specified within 4 inches of the surface of the street, and then filled with road gravel or shell to a point approximately

1 inch higher than the street level. After all other work is completed, the Contractor shall go back and remove sufficient shell and install 6 inches of concrete as ordered by the Engineer. The concrete used shall be paid for at the unit price bid in the proposed schedules.

On asphalt surfaced streets, the gravel or shell base shall be placed as stated above. At such time as the gravel or shell base shall be leveled smooth approximately one inch below the existing asphalt surface, the new asphalt pavement shall then be placed and rolled or tamped to a smooth and even surface.

3.10 Clean-Up: Contractor's equipment, surplus materials and surplus earth shall be removed from the job following the final test of mains and all street surfaces replaced before the final estimate will be approved.

3.11 Laying Sewer Pipe:

3.11.1 After the trench has been carefully graded, same must receive the approval of the inspector before any pipe is placed therein. Each piece of pipe shall be examined for defects, cut to the correct lengths, and the interior surface and the bell and spigot thoroughly cleaned of all foreign material prior to placing same in the trench in an approved manner. The pipe, valves, fittings, etc., shall be adjusted so as to be at their proper locations and then each spigot properly fitted into position. Each length of pipe shall rest on the bottom of the trench throughout its entire length.

3.11.2 Whenever the laying of pipe is discontinued for the day or for an indefinite period, a cap or plug shall be tightly placed in the end of the last pipe laid.

3.11.3 Instructions for jointing pipes with special couplings shall be in strict conformity with the Manufacturer's printed instructions.

3.11.4 Should a damaged piece of pipe furnished by the Contractor be placed in the sewer line, the Contractor shall furnish at his expense all labor and materials required for removing and replacing the defective pipe.

3.12 Force Main Thrust Blocking:

All force main lines shall be thrust blocked at bends, tees, caps, plugs, and fire hydrants to prevent movement of lines under pressure. The blocking shall be 3,000 psi concrete and shall completely fill the space between the solid ground and the fitting to be anchored in such manner that the pipe and the fitting joints will be accessible for repairs. Thrust blocking shall be installed at all points designated by the Engineer with no extra payment.

3.13 Pipe Not To Be Laid Until Inspected: No pipe shall be laid until same has been inspected and accepted by the Engineer.

Unless requested by the Contractor and approved by the Engineer, no pipe shall be laid within ten (10) feet of the excavating. Pipes having any defects which do not cause their rejection shall be so laid as to bring these in the top half of the sewers; and, if the bell or spigot be broken, the defective place must be liberally covered with cement mortar, reinforced with a piece of pipe or pipe-ring.

3.14 Adjustments: The pipes and specials shall be so laid in the trench so that, after the sewer is completed, the interior surface thereof shall conform accurately to the grades and alignments fixed and given by the Engineer.

The pipe shall be laid accurately to line and grade, with the spigot end down-stream entering the barrels to full depth and in such manner to not drag earth into the annular space. All adjustments to line and grade of pipes laid directly upon the bottom must be done by scraping away or filling the earth in under the body of the pipe and not by blocking or wedging up. All sewers must be laid in a perfectly straight line, so that a light can be seen from one manhole to the other even for the smaller size of sewers, and the Contractor will not be authorized to deviate from the given line without the authority of the Engineer. Before laying, the interior of the bell shall be carefully wiped smooth and clean, and the annular space shall be free from dirt, stone or water.

4. FIELD PERFORMANCE AND ACCEPTANCE:

4.1 Low Pressure Air Test: Maximum allowable infiltration or exfiltration shall be 200 gallons per inch of diameter per mile of sewer pipe per day. The joints shall be tight, and visible leakage in the joints or leakage in excess of that noted above shall be repaired at the Contractor's expense by any means found necessary. The pipe shall be tested in sections as directed by the Engineer. Exfiltration testing shall be used. The line shall be filled to a height of 2 feet above the inside of the top of pipe. The drop in water level in the downstream manhole over a two-hour period shall be used to compute the exfiltration. Final payment will not be made until each section passes the above testing procedure.

Air testing may be used as an option to water testing. While air testing may be used for final acceptance, should the air test fail, then a water test shall be performed in order to determine if the water leakage is no greater than specified in the above paragraph. The minimum time requirements for air testing for the 0.5 PSIG Pressure Drop, from 3.5 PSIG, to 3.0 PSIG, shall not be less than that shown in the following table:

Pipe Size (In.)	Time
4	2-1/2 Minutes
6	4 Minutes
8	5 Minutes
10	6-1/2 Minutes
12	7-1/2 Minutes
15	9-1/2 Minutes

4.2 Leakage Testing for Manholes:

4.2.1 After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.

4.2.2 Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer=s safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

4.2.3 Vacuum Testing:

(1) Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer=s instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.

(2) Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in the Manhole Vacuum Test Time Table.

(3) If drop in vacuum exceeds 1 inch Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

Manhole Vacuum Test Time Table

Depth in Feet	Time in Seconds by Pipe Diameter		
	48"	60"	72"
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0

*Add T times for each additional 2-foot depth.

(The values listed above have been extrapolated from ASTM C924-85)

4.2.4 Perform Hydrostatic Exfiltration Testing as Follows:

(1) Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.

(2) The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.

(3) If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

4.3 Testing of Force Mains:

4.3.1 After the pipe has been laid and partially backfilled, excepting at joints, all newly laid pipe shall, unless otherwise specified, be subjected to hydrostatic pressure 150 pounds and not less than 150% of the maximum anticipated sustained operating pressure.

4.3.2 Each valved section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. The Contractor will furnish, install, and operate, at his

expense, the necessary connections, pump, meter, and gauges. Evidence of the condition of the pump must be provided to the Engineer prior to testing.

4.3.3 Each section of pipe shall be tested just prior to chlorination. Before applying for the specified pressure test, all air shall be expelled from the pipe. Should the taps at points of highest elevation be required to accomplish this, then same will be installed by, and at the expense of, the Contractor.

4.3.4 All joints showing visible leaks discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the Engineer.

4.3.5 All pressure tests shall be performed using a minimum pressure of 150 psi at the highest point in the line. The time of the testing shall be a minimum of 4 hours.

4.3.6 The allowable leakage for P.V.C. and D.I. pipe shall not exceed the gallon per hour per 1,000 feet rate listed in the table below:

Pipe Size (Inches)	Allowable Leakage
2	0.16
4	0.33
6	0.49
8	0.66
10	0.82
12	0.99
16	1.32

For pipe diameters greater than sixteen (16) inches, leakage shall not exceed the rate of 0.08275 multiplied by the nominal pipe diameter inch.

4.3.7 Where practicable, pipe lines shall be tested in lengths between line-valves or plugs of no more than 1,500 feet.

4.3.8 If the leakage exceed the allowable rate, repairs must be made and the test must be redone until each segment passes the test.

4.3.9 All visible leaks at exposed joints, and all leaks evident on the surface where joints are covered, shall be repaired and leakage minimized, regardless of total leakage as shown by test.

4.3.10 All pipe, fittings, and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.

4.3.11 Lines which fail to meet the tests shall be repaired and restored as necessary, until test requirements are complied with.

END OF SECTION

SECTION 33 41 00
STORM SEWERS AND APPURTENANCES

1. SCOPE:

This specification covers storm sewers, culverts, manholes, headwalls, inlets, junction boxes, and miscellaneous items indicated in connection with the storm sewer system, complete. Excavation, backfilling, and other earthwork operations are specified under section entitled "Excavation, Trenching, and Backfilling Requirements".

2. GENERAL:

Pipe shall consist of the materials specified in this specification and in the same manner indicated on the drawings. Pipe shall be laid true to the grades shown on the drawings. Any line in which opening or faulting of the joints occurs during backfill or before final inspection and acceptance, such that infiltration of materials or a change in flow characteristics results, must be repaired or replaced to the satisfaction of the Engineer. Under no circumstances shall pipe be laid on unsuitable soft material, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Full responsibility for the diversion of drainage during construction shall be borne by the Contractor. Any section of the pipe already laid that is found to be defective or damaged shall be taken up and re-laid or replaced as directed by the Engineer, without additional cost to the Owner.

New manholes and inlets shall be precast concrete structures as manufactured by Hanson Pipe & Precast, Oldcastle Precast, or approved local equivalent.

Headwalls, inlets, and the miscellaneous alterations and extensions to existing drainage structures shall be constructed of the materials specified in this specification and in the drawings and shall conform to the dimensions, locations, and elevations shown on the drawings.

3. MATERIALS:

3.1 Corrugated Galvanized Metal Pipe: Shall be asphalt coated, as manufactured by Armco Drainage and Metal Products, Inc., or an approved equal and shall conform to the requirements of the Texas Department of Transportation Standard Specification Item 460. Thickness of metal, diameter and coating to conform to the plans.

3.2 Concrete Pipe for Storm Drains: Pipe for storm drains shall be reinforced concrete pipe (RCP), ASTM C76, not less than Wall B, Class III, unless otherwise indicated on the drawings or proposal. No concrete pipe shall be delivered to the site of the work until control cylinders representing such pipe shall have attained a compressive strength of at least 80% of the specified minimum strength.

3.3 Concrete Box Sections for Storm Drains: Box sections for storm drains shall be reinforced concrete box (RCB) manufactured in accordance with ASTM C850 (HS20 Loading), unless otherwise required. No concrete box sections shall be delivered to the work site until control samples representing such box sections have attained a compressive strength of at least 80% of the specified minimum strength.

4. INSTALLATION:

4.1 Laying Pipe: The laying of pipes on the prepared foundation shall be started at the outlet end with the spigot or tongue ends pointing in the direction of flow and shall proceed toward the inlet end with the abutting sections properly matched, true to the established lines and grades. The Contractor shall furnish and place in position all the necessary batter boards for controlling the work. The batter boards shall be of sufficient size timber and shall be substantially supported. The boards and all location stakes must be properly maintained in place. The Contractor shall also furnish, at his own expense, good sound twilled lines for use in giving lines and grades and the necessary plummets and graduated poles of a form approved. Contractor's use of laser equipment for grades is acceptable.

Proper facilities shall be provided for hoisting and lowering the sections of pipe into the trench without disturbing the prepared foundation and the sides of the trench. The ends of the pipe shall be carefully cleaned before the pipes are placed. As each length of pipe is laid, the mouth of the pipe shall be protected to prevent the entrance of earth or bedding material. The pipes shall be fitted and matched so that when laid in the bed they shall form a smooth, uniform conduit. Shape trench bottom and perform excavation as specified under the specification entitled "Excavation and Site Work".

4.2 Jointing: Unless otherwise specified, the following method of jointing for bell-and-spigot and tongue-and-groove pipe shall be used.

4.2.1 Cold Compound Joints, Tongue-and-Groove Joints: Pipe bells and the outside of the spigot ends shall, while dry, be completely coated with joint primer. This coating shall be applied sufficiently in advance so that the primer will be thoroughly dry when the pipe is laid. Pipe 24 inches and larger shall be primed at the point of manufacture. Apply a fillet of compound on the bottom half of the inside of the bell, press enough dry twisted jute into the compound to pass around the pipe and lap at the top and shove home the spigot of the pipe. Bring the jute around the pipe, firmly caulk into place. The jute should be sufficient to fill 1/4 of the depth of the bell. Fill the remaining 3/4 of the depth of the bell with compound, taking care to leave no voids and provide sufficient compound to form a fillet sloping 45 degrees from the outer end of the bell to the barrel of the next pipe.

Compound used for these joints shall be a well-known brand of materials of proven worth, uniform in consistency and approved by the Engineer as being equal to Talcote No. 052 or Gulf States No. GS 702 or 722. Primer shall be of the type recommended by the manufacturer of compound used.

5. MATERIALS FOR DRAINAGE STRUCTURES:

5.1 Concrete: Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for concrete under specification "Concrete", including the requirements for materials, proportions, mixing, placing, finishing, protection, curing, and the furnishing and construction of forms. The concrete covering over steel reinforcing shall be not less than 1-1/2 inches. When concrete is deposited directly against the ground, the covering will be at least 3 inches between the steel and the ground. Expansion joint filler material shall be formed by bituminous type conforming to AASHTO Specifications M-33 or rubber gasket joint if required by the local jurisdiction or the plans.

5.2 Mortar: Mortar for pipe joints and connections to other drainage structures shall be composed of one part by volume of Portland cement and two parts of sand. The Portland cement shall conform to the requirements of ASTM C-150, Type I. The sand shall conform to the requirements of AASHTO Specification M-45. Hydrated lime may be added to the mixture of sand and cement in an amount equal to 10% of the column of cement used. Hydrated lime shall conform to the requirements of ASTM Specifications C-207, Type S.

The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar, but shall in no case exceed 6 gallons of water per sack of cement. Water shall be clean and free of injurious acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes from the time the ingredients are mixed with water. The inside of the joint shall be protected for such a period as is necessary to obtain satisfactory curing.

5.3 Concrete Blocks: Concrete blocks shall conform to ASTM C-90, Type U-1.

5.4 Brick: Common brick conforming to the requirements of Federal Specifications SS-B-656, Class H, laid up in the specified mortar, may be used in lieu of concrete in the construction of sidewalls below the cover, where indicated on the drawings.

5.5 Cast Iron: Cast iron shall conform to ASTM Specification A-48 for Class 20 gray cast iron. Cast iron shapes shall conform to the dimensions shown and shall be clean and perfect, free from sand or blow holes, or other defects. Manhole steps shall conform to dimensions on drawings.

END OF SECTION

SECTION 33 71 74 - ELECTRICAL UTILITY SERVICES - UNDERGROUND

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes arrangement with Utility Company for permanent electric service; service provisions; and secondary service entrance from Power Company.

B. Coordination: Contractor shall be responsible for all coordination required for utility installation, connections and inspections.

1.3 REFERENCES

A. Section 26 05 50 - Basic Electrical Materials and Methods.

1.4 SYSTEM DESCRIPTION

A. Utility Company: CenterPoint Energy

B. System Characteristics: 480Y/277 volts, three phase, four- wire, 60 Hertz.

C. Service Entrance: Underground.

D. Underground Service Provisions: Underground service entrance to building service entrance equipment.
   1. Utility Service-Entrance Conductor Connection: At Utility Company's pad-mounted transformer.

1.5 SUBMITTALS

A. Submit utility service outlet agreement including Utility Company prepared installation drawings.

1.6 QUALITY ASSURANCE

A. Install service entrance in accordance with Power Company's Rules and Regulations.

B. Maintain one copy of each document on site.

1.7 COORDINATION

A. Coordinate with Utility Company, relocation of overhead or underground lines interfering with construction.

PART 2 - PRODUCTS

2.1 METERING EQUIPMENT

A. Coordinate with Power Company and provide equipment, conduits, manholes and equipment pads in accordance with Power Company directions.

2.2 CABLE TAP BOX

A. Submit two (2) copies of drawings of proposed cable tap box to the designated representative of the Electric Utility for approval prior to fabrication of cable tap box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Arrangements with Power Company shall be made to obtain permanent electric service to the Project.

B. Provide primary service entrance conduits from Power Company terminations. Power Company will connect conductors to transformer and provide primary cables.

C. Provide secondary service entrance conduits and wire from Power Company transformer to building service entrance equipment.

D. Provide raceway enclosures and attachment for metering equipment as required by Electric Utility.

E. Install cast-in-place concrete pad for Utility Company transformer.

3.2 CABLE TAP BOX

A. Conduit Between Transformer and CTB:
   1. Electric Utility requires conduits from padmount transformer to cable tap box. Install conduits in concrete ductbank from secondary opening of the transformer pad to the utility side of the cable tap box. Coordinate conductor installation with Utility Company.
   2. Prior to pouring concrete for conduit between transformer pad and cable tap box pad, obtain inspection and approval of trench by Electric Utility.

B. Conduit Between CTB and Building: Provide underground conduit and cable from tap box to main switchboard. All underground conduit shall be encased in reinforced concrete.
   1. Cable Termination: Terminate all cables on customer side of CTB with NEMA-pattern, two-hole, compression lugs.

3.3 CUSTOMER FAULT PROTECTION

A. General: Provide the following information for each service entrance overcurrent protective device. Electric Utility may furnish forms to be filled out or otherwise stipulate format of submittal. Provide information noted herein plus other items noted in Electric Utility drawings and specifications. Submit all data at least 30 days prior to service cut-in date. Contractor shall obtain device settings from submitted coordination study or, when

coordination study not required, as recommended by manufacturer of actual equipment installed on job site.

B. Coordination Study: Refer to Section 26 20 00 to determine if coordination study is required. When a coordination study is required, Contractor shall obtain and furnish a copy to the Electric Utility. Settings for main circuit breaker(s) shall be taken from coordination study and identified to Electric Utility.

3.4 PRIMARY DUCTBANK INSTALLATION

A. Routing: All proposed conduit for Electric Utility primary cables shall be installed in straight runs, unless otherwise indicated on Electric Utility drawings. Any conduit bends shall be installed with a 20 foot minimum radius, unless indicated otherwise on Electric Utility drawings. Conduit turn-ups into equipment pads and pole pedestals shall have a minimum five (5) foot radius. Conduit turn-ups (bends) determined by Electric Utility to be wrinkled, crumpled, or creased shall be replaced by the Contractor. Any deviations from these requirements shall have written approval from the Electric Utility prior to installation.

B. Conduit: During installation, the minimum depth for a conduit run shall be referenced to the final grade. Type EB rigid PVC conduit encased in red concrete, six (6) inches Inside Diameter. Slope as directed by Electric Utility.

C. Pulling Ribbon: Provide a 3/4 inch duct ribbon with numerical footage markings (Neptco #WP-2500P, or equivalent acceptable to the Electric Utility) in each conduit installed. This pulling ribbon shall extend a minimum of seven (7) feet beyond the end of the conduit.

D. Survey Wire: Provide a #14 American Wire Gage (AWG) or larger aluminum or copper 600 volt insulated conductor in the middle conduit. This conductor shall be electrically continuous from end-to-end of each ductbank. Conductor will facilitate surveying of the ductline by the Electric Utility. Take adequate measures to assure the conductor will be in place until all necessary surveying is completed.

E. Plugs: Conduit ends shall be plugged with a duct cap or other type capping device. The use of rags to plug conduits is prohibited. If the conduit is installed in stages, keep each section of conduit capped until the new section is installed. If, prior to Electric Utility using any conduit, the conduit is found to be blocked, the Contractor shall remove the obstruction, at Contractor expense.

F. Concrete: All cold joint concrete pours shall have four #5 rebar in place before any new concrete is poured; 3 feet-0 inches in length, exposed 1 foot-6 inches.

G. Ductbank Clearance:
1. Customer ductbank or any other non-electric utilities shall not be routed beneath pads for Electric Utility equipment (except for stub-up of Customer secondary ductbank).
2. Hold a one (1) foot minimum vertical clearance between Electric Utility ductbank and all other facilities.
3. Hold a five (5) foot minimum horizontal clearance between Electric Utility ductbank and other facilities running parallel to the ductbank.
4. Electric Utility will not allow joint trenching between electric ductbank and any other underground utilities.

H. Terminal Pole: Delay installation of approximately the last 20 feet of primary conduit

installation until the terminal pole location has been staked by the Electric Utility. Install conduit stub at the terminal pole only after the pole has been set by the Electric Utility. Securely brace the pole before trenching up to it. Contact Electric Utility to obtain schedule and any required observations by E.U. personnel.

I. Slack Secondary Conductor: When Contractor installs secondary conductor from the pole mount transformer to the building service entrance equipment, pull at least seven (7) feet of slack cable. This slack cable will be used by Electric Utility to make cable terminations onto lugs in transformer secondary compartment. Furnish compression body lug to Electric Utility for each service entrance cable.

J. Manholes: Provide manholes per Electric Utility Standards and one 5'x8' manhole per 300 linear feet of primary ductbank.

3.5 INSPECTION

A. Customer Installed: All customer-installed facilities to be used by Electric Utility shall be inspected by the Electric Utility after the conduit is installed, pads are formed, reinforcing rods installed and other work performed, but prior to the pouring of concrete. Contact Electric Utility at least 24 hours in advance, week days, regular business hours, non-holiday.

B. Final Inspection: Final on-site inspection will be made by Electric Utility to verify that all customer installed facilities are in accordance with Electric Utility service agreement specifications and terms and conditions. The customer (or customer's contractor) will be advised of any needed corrections and changes. Perform all corrections and changes as directed by Electric Utility at no additional cost to the Owner

END OF SECTION 33 71 74

SECTION 41 22 13.19 - JIB CRANES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: Freestanding, mast-mounted jib cranes with a 360 degree rotating boom.

B. Related Sections
   1. Section 03 30 00 “Cast-in-Place Concrete”.
   2. Section 05 12 00 “Structural Steel Framing”.
   3. Section 05 50 00 “Metal Fabrications”.

1.3 REFERENCES

A. American Institute of Steel Construction (AISC)
   1. Manual of Steel Construction, Part 5, Specification for Structural Joints using ASTM A 325 or ASTM A 490 Bolts

B. American National Standards Institute (ANSI)
   1. ANSI B30.11 – Monorails and Underhung Cranes

C. American Society for Testing and Materials (ASTM)
   1. ASTM A 36: Carbon Structural Steel
   2. ASTM A 325: Structural Bolts, Steel, Heat-Treated, 120/150 ksi Minimum Tensile Strength
   3. ASTM A 490: Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
   4. ASTM B 221: Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube

D. American Welding Society (AWS) D1.1
   1. Structural Welding Code
   2. Certified Shop

E. Occupational Safety and Health Administration (OSHA)
   1. 179: Overhead and Gantry Cranes

F. National Electric Code (NEC)

G. Society for Protective Coatings (SSPC)

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company with more than 10 years of experience successfully designing and manufacturing cranes and material handling solutions.

B. Cranes shall be designed, fabricated, and installed in accordance with ANSI B30.11, MH27.2, OSHA 1910.179, and applicable building codes and regulations.

C. Applications where cranes will be used in potentially hazardous environments or explosive environments require special consideration. These conditions must be disclosed to the crane manufacturer.

D. Applications where cranes will be used in essential facilities for groups such as emergency services, military, and communications or those located within 15 kilometers of known seismic sources require special consideration. These conditions must be disclosed to the crane manufacturer.

E. If crane design must conform to standards other than building code and ANSI, crane modifications may be required and must be coordinated with crane manufacturer.

F. Installer Qualifications: A company that is acceptable to the crane manufacturer and with at least five years of experience assembling and installing cranes for multiple applications. Installer must be able to:
   1. Perform welding using certified operators in accordance with AWS D1.1.
   2. Bolt connections in accordance with torque tightening procedures specified in AISC Manual, Part 5.
   3. Clearly label crane with rated load capacity with label visible from floor level and loading position
   4. Perform OSHA Load Test Certification

1.5 SUBMITTALS

A. A complete list of all items proposed to be furnished and installed under this Section.

B. Manufacturer's specifications, catalog cuts, and other data to demonstrate compliance with the specified requirements.

C. Shop drawings indicating crane configuration and dimensions

D. Manufacturer's recommended installation procedures which, when approved by the Architect, shall be the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

E. The Contractor shall be responsible for coordinating all Work of this section.

F. Manufacturer's warranty

G. Manufacturer's Operation and Maintenance Manual

1.6 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 "Project Coordination".

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products indoors and protect from moisture, construction traffic, and damage.
   1. Store products in manufacturer's packaging until ready for installation.
   2. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer

B. Store solvent-based materials in accordance with applicable regulations.

1.8 WARRANTY

A. Included warranty on manufacturer's standard form and outlining the manufacturer's agreement to repair or replace assemblies and components that fail in materials and/or execution within warranty period from date of substantial completion.
   1. Warranty shall cover ten (10) years or twenty thousand (20,000) hours for manual push-pull Crane products to cover defects in materials and execution.
   2. Warranty shall cover two (2) years or 4 thousand (4,000) hours for motorized tractor products.

PART 1 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on Spanco Freestanding Jib Cranes.
   1. Spanco: Morgantown, PA 19543; (800) 829-2080; www.spanco.com

B. Products of manufacturers listed which meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions to be considered.

2.2 PERFORMANCE REQUIREMENTS

A. Crane shall be designed, fabricated, and installed in accordance with ANSI B 30.11 and OSHA 1910.179

B. Crane shall be designed for Class C Normal / Industrial service as defined:
   1. Equipment is used where operational time is up to 100 percent of the work period and lifted load is at 50 percent or below rated capacity
   2. Equipment is used where operational time is less than 50 percent of the work period and lifed load is greater than 50 percent of rated capacity.
   3. Applications involving vacuums, magnets, and other high impact lifters are considered severe usage and require special design considerations

C. Coverage: Crane shall provide coverage of circular area of 25 foot radius.

D. Capacity: 1,000 lbs.

2.3 SYSTEM COMPONENTS

A. Materials: ASTM A36 steel with finished ends and surfaces

B. Crane (41 22 13.19.JC1):
   1. Freestanding, Mounted jib crane
   2. Rotating boom with 360-degree rotation and will not drift when at rest
   3. Mast:
      a. Stationary steel pipe perpendicular to boom
      b. Mast top plate and pivot pin to receive head assembly
   4. Head Assembly
      a. Construction: Standard plate, angles, and channels to ensure minimum deflection and maximum rigidity
      b. Plate: Reinforced using angles to limit compression and buckling stresses
      c. Lower Trunnion Roller Assembly: Mounted on a channel, which transfers the load to the top of the box
      d. Designed to inhibit dislodgement due to upward and forward motion while allowing .
      e. Utilize a Timken tapered roller bearing provided with grease fitting for proper lubrication.
      f. Welded steel plate and channel fabrication fitted over mast, bolted to boom, and designed to transfer boom load to mast and rotate.
      g. Bearings shall be designed for 5000-hour, B-10 design lift.
      h. Allow for installation of head prior to boom attachment and provide maximum hoist lift.
         1) Top pivot bearing assembly: Designed to connect head assembly to mast and transfer load from boom. Weight bearing channel connects the sides of the head assembly and contains tapered roller bearings that allow for easy rotation.
         2) Retaining clip: Inserted through mast pivot pin above weight bearing channel to prevent accidentally dislodging head assembly.
         3) Trunnion roller assembly: Designed to rotate around mast and transmit moment force from boom to mast. Includes trunnion rollers with tapered bearings held in steel channel with bolts. A mast that is less than 18 inches in diameter will have two rollers, and larger masts will have four rollers. Assembly rotates around mast with full roller face contact. Roller surface is sufficiently large to prevent cutting into mast. Cranes with small rollers or cams requiring wear band on mast are not acceptable.
   5. Trolley:
      a. Basis of Design: Manual Trolley as manufactured by Spanco.
         1) Features:
            (a) Adjustable Flange Widths.
            (b) Side Plate Material: Cast Iron.
            (c) Crown Wheels.
   6. Electric Chain Hoist:
      a. Basis of Design: Electric Chain Hoist as manufactured by Spanco.
         1) Features:
            (a) Capacity: 1-Ton

(b) Push Button Pendent
(c) Grade 80 Chain.
(d) Power: 480 V 3 phase power.
(e) Power Cord and power cord length of 3 feet.

2) Coordinate with mechanical engineer.

C. Crane shall be designed for minimum effort manual rotation.

D. Crane shall be designed to manually move load with maximum force to load weight ratio of 1/100.

E. Maximum deflection shall be L/150

F. Operating temperature range shall be 5 to 200 degrees F (-15 to 93 degrees C)

G. The Crane's structural design shall be based upon the following:
1. Hoist and Trolley: Live load capacity plus 15 percent
2. Impact: Live load capacity plus 25 percent
3. Inertia forces from crane and load movement
4. Live load capacity equal to net rated hook load

2.4 SHOP FINISHING

A. Standard Paint Colors
1. All runways and structural supports are to be shop painted in a standard color selected by the Architect from the manufacturer's line of standard colors.
2. All bridges are to be painted safety yellow.

B. Surface Preparation and Painting Procedures
1. Follow the standards of the Society for Protective Coatings (SSPC) for all product surface preparation.
2. Deburr, descale, and wash components prior to painting.
3. Coat all components with a semi-gloss enamel to a minimum dry-film thickness of three mils.

PART 1 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until satisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install the Work of this Section in strict accordance with the approved shop drawings, the original design, and all pertinent regulations and codes, anchoring all components firmly into position for long life under hard use.

B. Install products in accordance with manufacturer's instructions.

C. Do not install products under environmental conditions outside of manufacturer's absolute limits.

3.3 TESTING

A. Upon completion of the installation, and as a condition of its acceptance, provide all necessary equipment and personnel and perform all tests required. Secure all required approvals from agencies having jurisdiction.

3.4 ADJUSTING AND CLEANING

A. Fit, align, and adjust crane level and plumb

B. Verify that crane operates smoothly and in accordance with manufacturer's specifications

C. Provide any required lubrication and other preparation as required prior to use.

D. Clean any excess lubricants and dirt from unit.

3.5 DEMONSTRATION

A. Instruct the Owner's personnel in proper operation and maintenance of units.

END OF SECTION 41 22 13.19